# FINAL
# Environmental Assessment
# for
# Designation of Revised Critical Habitat
# for
# Roswell Springsnail, Koster's Springsnail, Noel's Amphipod, and Pecos Assiminea

U.S. Department of the Interior
Fish and Wildlife Service
Region 2

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# 1.0 PURPOSE OF AND NEED FOR ACTION

## 1.1 Introduction

The U.S. Department of the Interior (USDI), Fish and Wildlife Service (Service) has prepared this Environmental Assessment (EA) to analyze potential effects to physical and biological resources and social and economic conditions that may result from designation of revised critical habitat in west Texas and southeast New Mexico for four invertebrate species. These four invertebrate species are Roswell springsnail (*Pyrgulopsis roswellensis*), Koster's springsnail (*Juturnia kosteri*), Pecos assiminea (*Assiminea pecos*), and Noel's amphipod (*Gammarus desperatus*)[1]. All four of these species are listed as endangered under the Endangered Species Act of 1973 (ESA), as amended.

This EA will be used by the Service to decide whether revised critical habitat will be designated as proposed, if the proposed action requires refinement, or if further analyses are needed through preparation of an environmental impact statement. If the proposed action is selected as described or with minimal changes and no further environmental analyses are needed, a Finding of No Significant Impact will be prepared. This EA has been prepared pursuant to the requirements of the National Environmental Policy Act of 1969 (NEPA) as implemented by the Council on Environmental Quality regulations (40 CFR §1500, *et seq.*)[2] and Department of the Interior NEPA procedures.

The EA is organized in five chapters. Chapter 1 contains introductory information on critical habitat and the four invertebrates and describes the purpose of and need for the action. Chapter 2 describes the alternatives for critical habitat designation, including the No Action alternative, and provides a summary comparison of the effects of the alternatives. Chapter 3 presents the existing conditions and discloses the effects of the alternatives for critical habitat designation on relevant resource areas. Chapter 4 is the analysis of significance of the proposed action, and Chapter 5 is a list of references cited in the EA.

## 1.2 Purpose and Need for Action

While species extinction can and does occur naturally, the current rate of extinctions is estimated to be many times greater than the natural "background" rate, due to the effects of human actions (*e.g.*, Wilson, 1992; Ward, 2004). Recognition that human activities "untempered by adequate concern and conservation" were causing species extinctions was the primary reason for enacting the Endangered Species Act of 1973 (*cf.* ESA §2[a][1]). In developing the law, Congress found that the biological diversity and natural heritage of the United States had "esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people" (*cf.* ESA §2[a][3]). The ESA is now the main federal law for protecting and recovering species that are in danger of extinction, thereby conserving the biological diversity and natural heritage of the United States.

[1] Roswell springsnail, Koster's springsnail, and Pecos assiminea are snail species (mollusks), while Noel's amphipod is a crustacean species. The four invertebrate species are described in more detail in section 1.4.2.

[2] CFR is an abbreviation for the Code of Federal Regulations, which can be accessed via the Internet at http://www.gpoaccess.gov/cfr/index.html (current web address as of 8 April 2010).

Critical habitat is defined in the ESA as areas that are essential for the conservation[3] of a species (see section 1.4.1 below for an in-depth discussion of critical habitat). The Service is required to designate critical habitat, to the maximum extent prudent, at the time species are listed as threatened or endangered (ESA §4[a][3]; 50 CFR §424.12), or within defined time frames after listing if critical habitat is not determinable at the time of listing. Designation of critical habitat is not considered to be prudent when: 1) the species is threatened by taking or other human activity, and identification of critical habitat can be expected to increase the degree of threat to the species; or 2) designation of critical habitat would not be beneficial to the species (40 CFR §424.12[a][1]). The critical habitat provisions of the ESA are intended to provide protection of habitat that is essential to the conservation of listed species, which includes that habitat necessary for recovery of the species. A primary purpose of the ESA is to "provide a means whereby the ecosystems upon which endangered species and threatened species may be conserved" (ESA §2[b]).

The Service published a final rule in the Federal Register on 9 August 2005 that listed Roswell springsnail, Koster's springsnail, Pecos assiminea, and Noel's amphipod (hereafter collectively referred to as "the four invertebrate species") as endangered under the ESA (70 FR 46304)[4]. The primary reasons for listing the four invertebrate species as endangered were "local and regional groundwater depletion, surface and groundwater contamination, oil and gas extraction activities within the supporting aquifer and watershed, and direct loss of their habitat (*e.g.*, through burning or removing marsh vegetation, cementing, or filling habitat)" (67 FR 6459).

Critical habitat was also designated in the August 2005 final rule, but only for Pecos assiminea at two sites in west Texas that are owned by The Nature Conservancy (380 acres at Diamond Y Spring and 16.5 acres at East Sandia Spring; 70 FR 46304: 46323)[5]. Proposed critical habitat units at Bitter Lake National Wildlife Refuge in New Mexico for Pecos assiminea and the other three species were excluded from designation in the final rule. The Service determined that special management considerations or protections for the four invertebrate species were not needed at Bitter Lake National Wildlife Refuge because the refuge lands were already being managed for conservation of wildlife, including the four invertebrate species. Therefore, the Service concluded that the refuge lands did not meet the definition of critical habitat and exclusion of the refuge lands under section 3(5)(A) of the ESA was appropriate (70 FR 46304: 46323-46324).

A complaint challenging the merits of the critical habitat designation was filed by Forest Guardians and Center for Biological Diversity on 19 December 2007 (U.S. District Court for the District of New Mexico, Case No. 07-cv-1277). The plaintiffs contended that the final critical habitat designation violated the ESA because: 1) it did not designate any critical habitat for Roswell springsnail, Koster's springsnail, or Noel's amphipod; 2) the final designation did not consider scientific evidence indicating that recovery of the four invertebrate species could not be accomplished without the protection of refuge lands and other areas outside of the refuge; and 3) the Service did not consider best available science on the threat posed by global

[3] Conservation is defined in the ESA as the use of "all methods and procedures which are necessary to bring any endangered or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary."

[4] This is a reference to the Federal Register (abbreviated as FR), which is "the official daily publication for rules, proposed rules, and notices of Federal agencies and organizations, as well as executive orders and other presidential documents." Federal Register volumes from 1994 to present can be accessed via the Internet at http://www.gpoaccess.gov/fr/index.html (current web address as of 8 April 2010).

[5] Citations in this Environmental Assessment often point to the specific page number of the reference, indicated by the number following the colon. For example, (70 FR 46304: 46323) refers to page number 46323 of the final rule published in the volume 70 of the Federal Register. Full citations are provided at the end of the Environmental Assessment in the section titled *References*.

warming. The complaint was resolved with a stipulated settlement agreement adopted on 11 December 2008 (U.S. District Court for the District of New Mexico, Case No. 07-1277 JCH [LCS]), in which the Service agreed to a remand with partial vacatur of the decision not to designate critical habitat at the Bitter Lake National Wildlife Refuge in order to reconsider the federal exclusions made under section 3(5)(A) of the ESA. Critical habitat designation for the Pecos assiminea in Texas remained in place.

In June 2010, the Service published a draft rule to designate four units of critical habitat comprising 515 acres for the four species. Public comments on that rule prompted the Service to add an additional unit of proposed critical habitat for Noel's amphipod on the South Tract of Bitter Lake National Wildlife Refuge. This additional unit encompass 5.8 acres.

The purpose of the proposed action analyzed in this EA is to designate revised critical habitat for the four invertebrate species, which reconsiders the federal exclusions previously made under section 3(5)(A) of the ESA. Critical habitat designation identifies geographic areas that are essential for conservation of the four invertebrate species. It also describes the physical and biological features that constitute critical habitat (*i.e.* primary constituent elements).

Conservation of the four invertebrate species may benefit from proposed revised critical habitat designation. Each federal action that may affect designated critical habitat would be reviewed to analyze the effects of the action and its relationship to the function and conservation role of the critical habitat. Designation of revised critical habitat may also help focus conservation activities for the four invertebrate species, alert the public and land-management agencies to the importance of specific areas for their conservation, and identify areas that may require special management. The critical habitat provisions of the ESA were intended to address habitat requirements for conservation of listed species. Threats to the four invertebrate species would not increase with critical habitat designation. Collection is not known to threaten any of the four invertebrate species. Information on their occurrence and distribution is already available to the public.

The entire distribution of the four invertebrate species consists of a few small, isolated aquatic habitats in the Pecos River drainage in southeastern New Mexico and west Texas. Recent population extinctions caused by habitat loss and degradation have been documented for all four invertebrate species (Cole, 1981; Taylor, 1987; Cole, 1988*a*; Taylor, 1987; Lang, 1998). Currently, Roswell springsnail, Koster's springsnail, and Noel's amphipod are known to occur only at Bitter Lake National Wildlife Refuge and adjacent land owned by the City of Roswell. Pecos assiminea occurs at four isolated locations in the United States: two springs in Texas, several disjunct locations on Bitter Lake National Wildlife Refuge, and a spring system on City of Roswell land adjacent to the southwest corner of the Middle Tract of the refuge.

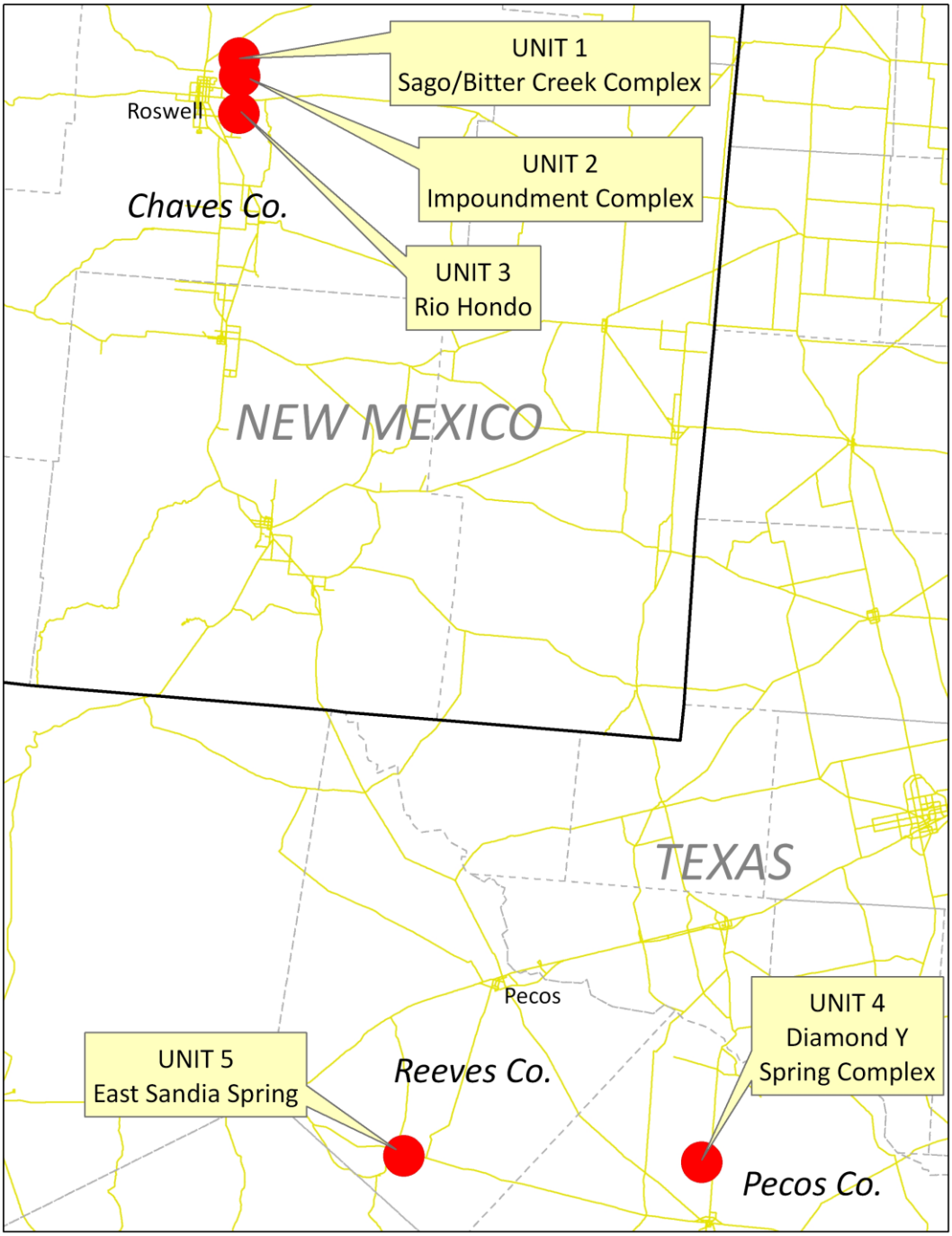
## 1.3 Proposed Action

The Service is proposing to designate critical habitat for Roswell springsnail, Koster's springsnail, Noel's amphipod, and Pecos assiminea in five geographic units; three of which are in New Mexico and two which are in Texas (Figure 1). These five geographic units constitute the current best assessment of areas that meet the definition of critical habitat for the four invertebrate species. The proposed action would designate 70.6 acres of critical habitat for Roswell springsnail and Koster's springsnail, and 76.4 acres of critical habitat for Noel's amphipod. A total of 515 acres of critical habitat would be designated for Pecos assiminea, which includes 70.6 acres that would be designated for the other three species.
The Service listed the four invertebrate species as endangered in a final rule published on 9 August 2005 (70 FR 46304). Included in this rule was designation of 396.5 acres of critical habitat for the Pecos assiminea at two sites in west Texas. Because of minor revisions in the primary constituent elements for the species

as well as a revised habitat mapping approach and acreage recalculations, some of the boundaries or acreage of critical habitat units are different from those proposed in 2002 (67 FR 6459) and the final designation in 2005 (70 FR 46304).

Critical habitat unit descriptions are summarized in this EA in Section 2.3. All of the proposed critical habitat units were occupied by one or more of the invertebrate species at time of listing in 2005 and are currently occupied by at least one of the four invertebrate species. Proposed critical habitat for Noel's amphipod along the Rio Hondo on the South Tract of Bitter Lake National Wildlife Refuge was known to be occupied by a species of amphipod from collections made there in 2006. The specimens collected in 2006 through 2009 were subsequently analyzed and in 2010 were found to be Noel's amphipod (Berg, 2010; Lang, 2010). In all likelihood, then, Noel's amphipod occurred at the Rio Hondo site in 2005, when the species was listed. Each critical habitat unit includes sufficient primary constituent elements in the quantity and spatial arrangement to support life history functions essential for the conservation of the species.

**Figure 1**. Location of the proposed critical habitat units for the four invertebrate species**.**



# 1.4 Background

## 1.4.1 Critical Habitat

1.4.1.1 Provisions of the ESA Section 4(a)(3) of the ESA states that critical habitat shall be designated to the maximum extent prudent and determinable and that such designation may be revised periodically, as appropriate. Section 4(b)(2) of the ESA requires that critical habitat designation be based on the best scientific and commercial information available and that economic and other impacts must be considered. Areas may be excluded from critical habitat designation if it is determined that the benefits of excluding them outweigh the benefits of their inclusion, unless failure to include the areas in critical habitat would result in extinction of the species.

Critical habitat is defined in section 3(5)(A) of the ESA as:

> "(I) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of this Act, on which are found those physical and biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection;

and

> (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of this Act, upon a determination by the Secretary that such areas are essential for the conservation of the species."

Section 3(5)(c) also states that critical habitat "shall not include the entire geographical area which can be occupied by the threatened or endangered species" except when the Secretary of the Interior determines that the areas are essential for the conservation of the species.

Section 7(a)(2) of the ESA requires federal agencies to consult with the Service to "insure that any action authorized, funded, or carried out by such agency ... is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined ... to be critical." Each agency is required to use the best scientific and commercial data available. This consultation process is typically referred to as section 7 consultation. Section 7 of the ESA does not apply to state, local, or private land unless there is a federal nexus (*i.e.* federal funding, authorization, or permitting).

Designation of critical habitat can help focus conservation activities by identifying areas that are essential to the conservation of the species, regardless of whether they are currently occupied by the listed species. Designation of critical habitat also serves to alert the public and land management agencies to the importance of an area for conservation of a listed species. As described above, critical habitat receives protection from destruction or adverse modification through required consultation under section 7 of the ESA. Aside from outcomes of consultation with the Service under section 7, the ESA does not automatically impose any restrictions on lands designated as critical habitat.

1.4.1.2 The Section 7 Consultation Process The section 7 consultation process begins with a determination of effects on listed species and designated critical habitat by the federal action agency (Figure 2). If the federal action agency determines that there would be no effect on listed species or designated critical habitat, the proposed action is not altered or impacted by ESA considerations. If the federal action

agency determines that listed species or designated critical habitat may be affected, then consultation with the Service is initiated.

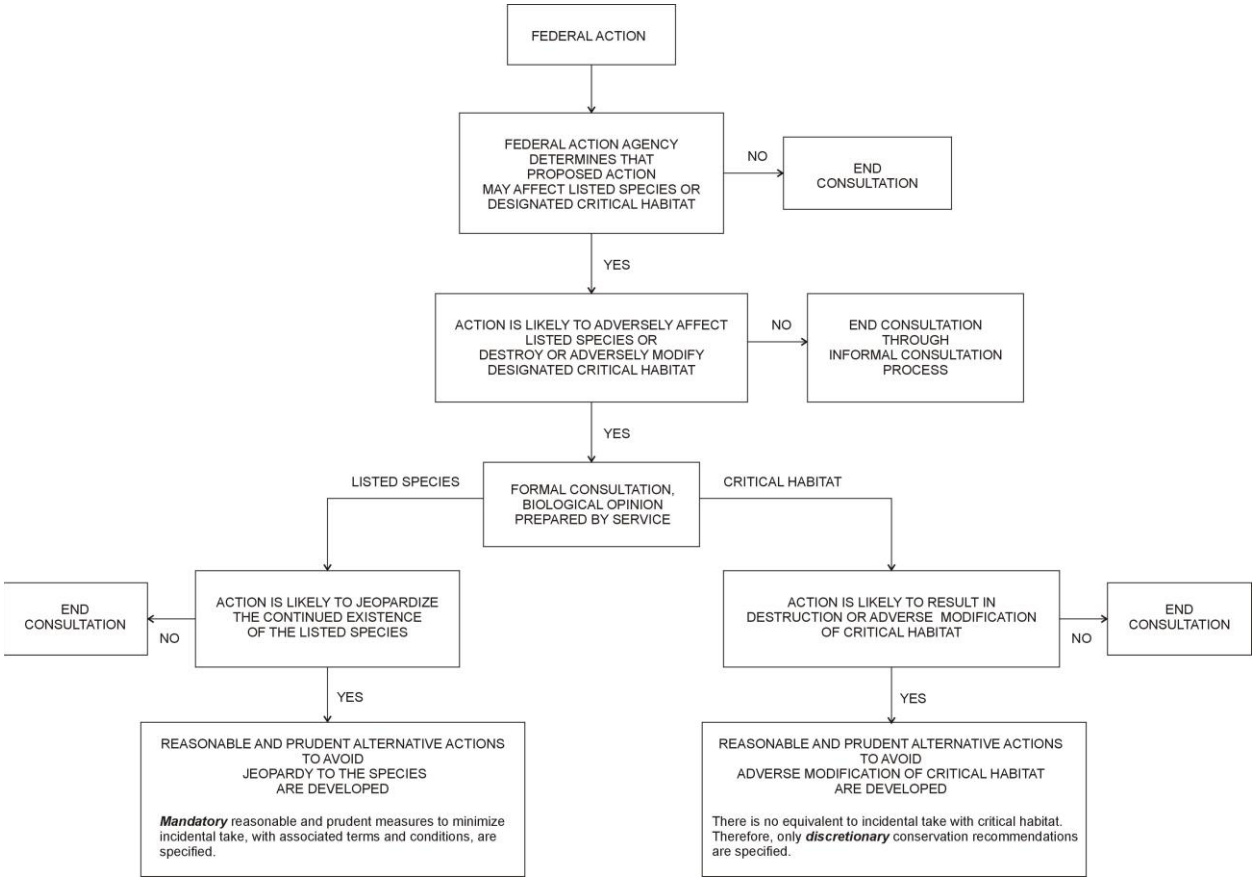
Once it is determined that the proposed federal action may affect a listed species or critical habitat, the federal action agency and the Service typically enter into informal section 7 consultation. Informal consultation is an optional process for identifying affected species and critical habitat, determining potential effects, and exploring ways to modify the action to remove or reduce adverse effects to listed species or critical habitat (50 CFR §402.13). The informal section 7 consultation process concludes in one of two ways: 1) the Service concurs in writing that the proposed action is not likely to adversely affect listed species or critical habitat; or 2) adverse effects are likely to occur and formal consultation is initiated.

Formal consultation is initiated when it is determined that the proposed federal action is likely to adversely affect a listed species or critical habitat (50 CFR §402.14). Formal consultation concludes with a biological opinion issued by the Service on whether the proposed federal action is likely to jeopardize the continued existence of a listed species or result in destruction or adverse modification of critical habitat (50 CFR §402.14[h]). Independent analyses are made under both the jeopardy and the adverse modification standards.

A "non-jeopardy" or "no adverse modification" opinion concludes consultation and the proposed action may proceed under the ESA. The Service may prepare an incidental take statement with reasonable and prudent measures to minimize take of listed fish or wildlife species, and associated, mandatory terms and conditions that describe the methods for accomplishing the reasonable and prudent measures (ESA §7[b][4]). Discretionary conservation recommendations may also be included in a biological opinion based on effects to species.

Conservation recommendations, whether they relate to the jeopardy or adverse modification standard, are discretionary actions recommended by the Service. These recommendations may address minimizing adverse effects on listed species or critical habitat, identify studies or monitoring, or suggest how action agencies can assist species under their own authorities and section 7(a)(1) of the ESA. There are no ESA section 9 prohibitions for critical habitat.

**Figure 2**. Simplified diagram of the ESA section 7 consultation process showing the parallel track for listed species and designated critical habitat. The informal section 7 consultation process leading to a determination of no adverse effect to listed species or designated critical habitat is not portrayed in detail.



1.4.1.3 Proposed Primary Constituent Elements In accordance with sections 3(5)(A)(I) of the ESA and regulations at 50 CFR §424.12, the Service is required to consider those physical and biological habitat features, called primary constituent elements, that are essential to conservation of the species. Proposed primary constituent elements include: 1) space for individual and population growth and for normal behavior; 2) food, water, air, light, minerals, or other nutritional or physiological requirements; 3) cover or shelter; 4) sites for breeding, reproduction, or rearing (or development) of offspring; and 5) habitats that are protected from disturbance or are representative of the historic, geographical, and ecological distributions of a species. Proposed primary constituent elements of critical habitat for Roswell springsnail, Koster's springsnail, and Noel's amphipod are:

- permanent, flowing, unpolluted, fresh to moderately saline water;
- slow to moderate water velocities over substrates ranging from deep organic silts to limestone cobble and gypsum substrates; and
- stable water levels with natural diurnal and seasonal variation.

Proposed primary constituent elements for Pecos assiminea are:

- permanent, flowing, unpolluted, fresh to moderately saline water;
- moist or saturated soil at stream or spring run margins with native vegetation growing in or adapted to aquatic or very wet environments, such as salt grass or sedges; and
- stable water levels with natural diurnal and seasonal variation.

## 1.4.2 Background Information on the Four Invertebrate Species

1.4.2.1 Description All four invertebrate species have only recently been described to science. Noel's amphipod was described as a new species in 1981 (Cole, 1981), whereas Roswell springsnail, Koster's springsnail, and Pecos assiminea were all described as new species in 1987 (Taylor, 1987).

The three snail species (Roswell springsnail, Koster's springsnail, and Pecos assiminea) are small (Figure 3 A through D). Roswell springsnail is light tan colored. Shell length ranges from 0.10 to 0.15 inches and shells have four to five moderately convex whorls (Hershler, 1994: 63). Koster's springsnail is also tan colored and shell length ranges from 0.10 to 0.18 inches. Shell width ranges from 0.06 to 0.10 inches and shells have up to 5¾ regularly convex whorls. Females are typically larger than males (Taylor, 1987: 45-46). Pecos assiminea has a chestnut-brown colored, translucent shell that ranges in length from 0.05 to 0.08 inches. The shell has up to 4½ strongly convex whorls (Taylor, 1987:8).

Noel's amphipod is a small freshwater crustacean. Amphipods are also commonly known as "scuds" or "sideswimmers" (Thorp and Covich, 2001: 788). Noel's amphipod is greenish-brown colored, with bands of red on the sides of the body (Figure 3 E and F). Noel's amphipod ranges in length from 0.37 to 0.58 inches for males and 0.34 to 0.50 inches for females (Cole, 1981:31; Cole, 1988*a*: 3-4).

Roswell springsnail is in the family Hydrobiidae. This springsnail was initially considered by Taylor to be in the genus *Fontelicella* (Taylor, 1987: 15). However, Hershler and Thompson (1987: 25) subsequently allocated the genus *Fontelicella* to *Pyrgulopsis*. Hershler reassigned *Fontelicella roswellensis* to *Pyrgulopsis rowellensis* in 2002 (Hershler, 1994: 63). Koster's springsnail is also in the family Hydrobiidae. Although initially considered by Taylor (1987: 45) to be in the genus *Tryonia*, the species was reassigned first to the genus *Durangonella* (Hershler, 2001: 15) and then to the new genus *Juturnia* in 2002 (Hershler *et al.*, 2002: 175). Pecos assiminea is in the family Assimineidae, and is unique in that it is the most inland species of the primarily marine genus *Assiminea*.

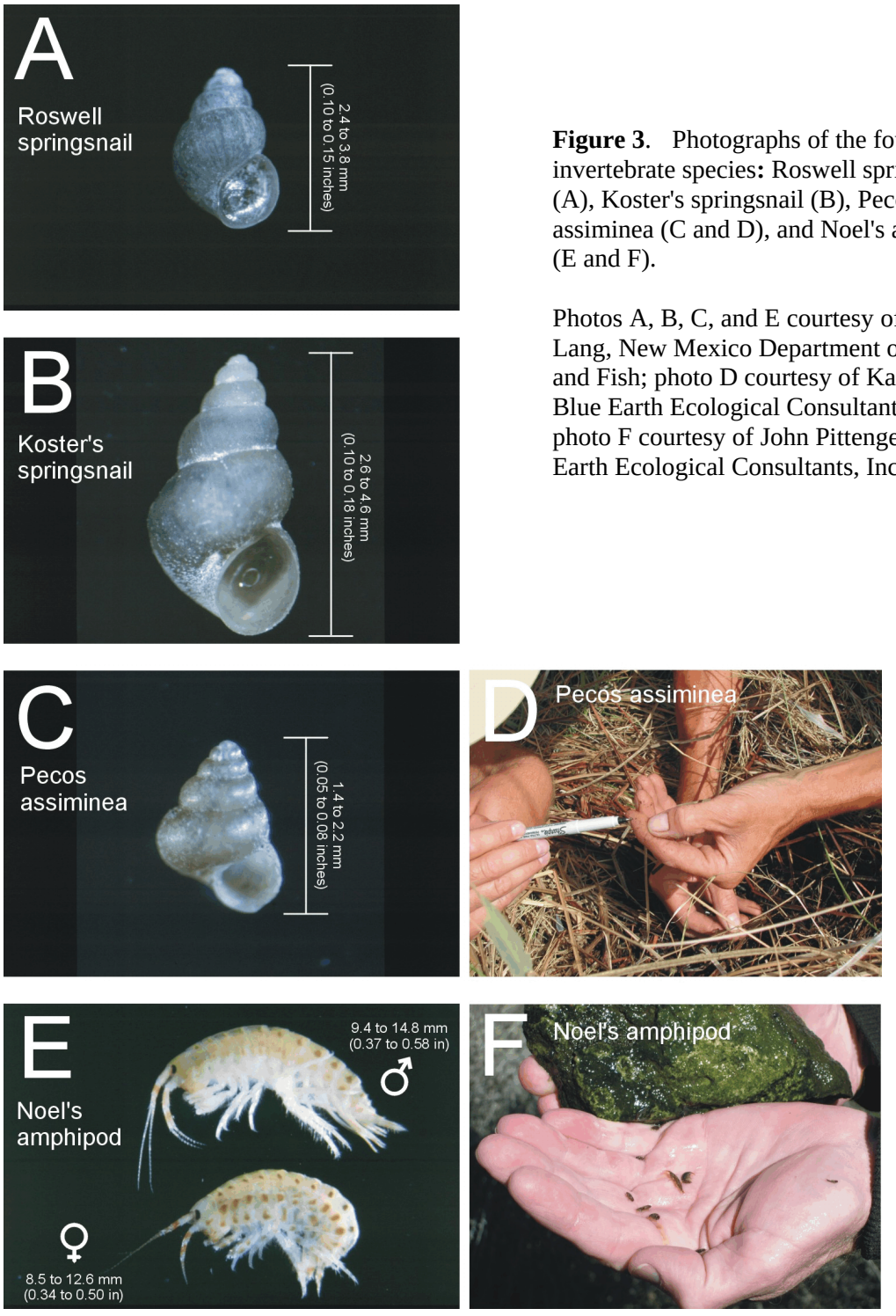



**Figure 3**. Photographs of the four invertebrate species**:** Roswell springsnail (A), Koster's springsnail (B), Pecos assiminea (C and D), and Noel's amphipod (E and F).

Photos A, B, C, and E courtesy of Brian K. Lang, New Mexico Department of Game and Fish; photo D courtesy of Karen Yori, Blue Earth Ecological Consultants, Inc.; photo F courtesy of John Pittenger, Blue Earth Ecological Consultants, Inc.).

Noel's amphipod is in the family Gammaridae. Noel's amphipod is one of three described and four undescribed *Gammarus* species collectively known as the *Gammarus-pecos* complex (Cole, 1985). The *Gammarus-pecos* complex occurs in the Pecos River basin from Roswell, Chaves County, New Mexico south to Fort Stockton, Pecos County, Texas.

1.4.2.2 Distribution All four species are restricted to small, isolated, spring-fed aquatic and wetland habitats in the Pecos River drainage. Fossil specimens of Roswell springsnail have been collected from Berrendo Creek and the Pecos River northeast of Roswell (Taylor, 1987: 16). Four populations of Roswell springsnail were known when the species was described in 1987. All of these occurred in Chaves County, and three of them were within Bitter Lake National Wildlife Refuge. The latter were located at a seep draining into a ditch along the west side of Unit 6, a seepage area on the west side of Unit 7, and Sago Spring. The fourth population was known from North Spring on the Roswell Country Club grounds from collections made from 1968 to 1981 (Taylor, 1987: 16).

Current distribution of Roswell springsnail appears to be restricted to Bitter Lake National Wildlife Refuge and City of Roswell property adjacent to the southwest corner of the refuge. A survey of the Roswell Country Club conducted in 2004 indicated that Roswell springsnail is no longer present there (M. Myers, Service, pers. comm., 18 April 2005). Roswell springsnail persists in Bitter Creek, Sago Spring, Sinkhole No. 32, along the western boundary of Unit 6 (Mehlhop, 1992; Mehlhop, 1993; Lang, 2002: A16), and in an area of springs and seeps on City of Roswell land adjacent to the southwest corner of the refuge. The seep area on the western boundary of Unit 7 was reported as being dry in 1992 (Mehlhop, 1992: 5), and Lang (1998: B69) confirmed that the species was no longer found there.

Fossil shells of Koster's springsnail, presumably of Pleistocene age, have been collected from North Spring River, South Spring River, Berrendo Creek, and the Pecos River near Roswell (Taylor, 1987: 47). Five populations of Koster's springsnail, all from New Mexico, were known when the species was described in 1987. Four of these populations were on Bitter Lake National Wildlife Refuge at the following locations: throughout Bitter Creek; in a 0.25-mile reach of an unnamed creek along the west side of Unit 3; in a seep draining into a ditch along the west side of Unit 6; and at Sago Spring. The fifth population was known from North Spring on the Roswell Country Club from collections made from 1968 to 1981 (Taylor, 1987: 47).

The current distribution of Koster's springsnail appears to be restricted to Bitter Lake National Wildlife Refuge and City of Roswell property adjacent to the southwest corner of the refuge. A survey conducted in 2004 indicated that Koster's springsnail no longer occurs at the Roswell Country Club site (M. Myers, Service, pers. comm., 18 April 2005). Therefore, the status of the population there is unknown. Koster's springsnail persists in Lake St. Francis, Dragonfly Spring, Bitter Creek, Sago Spring, Sinkhole No. 32, the southwestern corner of Unit 15, the northwestern border of Hunter Marsh, in isolated locations along the western boundaries of Units 5, 6, and 7 (Mehlhop, 1992; Lang, 2002: A16), and in an area of springs and seeps on City of Roswell land adjacent to the southwest corner of the refuge. Koster's springsnail has not been found in recent times along the western boundary of Unit 3 (Lang, 2002: A16).

When Pecos assiminea was described in 1987, extant populations were found at three isolated localities: Bitter Lake National Wildlife Refuge in Chaves County, New Mexico; Diamond Y Draw in Pecos County, Texas; and in the Bolsón de Cuatro Cienegas, Coahuila, Mexico (Taylor, 1987: 9). However, recent genetic analysis suggest that the Cuatro Cienegas population is not conspecific with *P. assiminea* (Hershler *et al*., 2007). Taylor (1987: 8-9) reported extirpation of two populations in Chaves County: one at North Spring on the Roswell Country Club and the other at a location on Bitter Lake National Wildlife Refuge.

Taylor (1987: 9) reported fossil Pecos assiminea from along the Pecos River near Grandfalls, Texas and the Rio Monclova, Coahuila, Mexico.

Pecos assiminea persists at Diamond Y Spring in Pecos County, Texas (Lang, 2002: A5). A previously-unknown population was discovered at East Sandia Spring in Reeves County, Texas on private lands under stewardship of The Nature Conservancy (Lang, 2000: A3). The species also persists at Bitter Lake National Wildlife Refuge and on City of Roswell property adjacent to the southwest corner of the refuge. Populations on Bitter Lake National Wildlife Refuge currently are found in the upper reaches of Bitter Creek near Dragonfly Spring, the lower end of Bitter Creek near Bitter Lake, the lower reaches of the Sago Spring wetland complex near Sinkhole No. 32, very localized on the western perimeter of Unit 7, and at a spring in the extreme southwestern corner of Unit 15 (Lang, 2002: A5).

Noel's amphipod was historically known from Lander Springbrook, a tributary of the South Spring River near Roswell, where it was collected by Martha S. Noel in 1950 (Noel, 1954: 124) and North Spring on the Roswell Country Club from collections made in August 1967 and August 1978 (Cole, 1981: 27). Noel's amphipod was also collected from a sinkhole and from Bitter Creek (*i.e.*, "Lost River") on Bitter Lake National Wildlife Refuge in 1988 (Cole, 1988*b*: 2).

The Lander Springbrook population of Noel's amphipod was extirpated by about 1960 with drying of the spring (Cole, 1981: 27; Cole, 1988*a*: 1). The North Spring population of Noel's amphipod appears to have been extirpated as a result of habitat modification that occurred prior to May 1988 (Cole, 1981: 27; Cole, 1988*a*: 2). Noel's amphipod currently persists on Bitter Lake National Wildlife Refuge at the Sago Spring wetland complex (including Sinkhole No. 32), Bitter Creek, and along the western boundary of Unit 6 (Lang, 1999: A1; Lang, 2002: A2). Noel's amphipod appears to be declining at Dragonfly Spring at the headwaters of Bitter Creek following the Sandhill Fire that burned through the area in March 2000 (Lang, 2002: A2). Noel's amphipod also occurs in a spring system on City of Roswell land adjacent to the southwest corner of Bitter Lake National Wildlife Refuge. Finally, a previously unknown population of Noel's amphipod was documented in 2006 to 2009 from a series of small springs located along the bank of a segment of the Rio Hondo on the South Tract of Bitter Lake National Wildlife Refuge (Lang, 2010). Collections taken at this location in 2006 revealed the presence of a species of amphipod. The specimens collected in 2006 through 2009 were subsequently analyzed both in terms of morphology and genetics and in 2010 were determined to be Noel's amphipod (Berg, 2010; Lang, 2010).

1.4.2.3 Reproduction and Life History Roswell springsnail and Koster's springsnail are dioecious[6]. Fertilization is internal in both species. Roswell springsnail is oviparous (*i.e.*, it lays eggs; New Mexico Department of Game and Fish, 1988: B-300), while Koster's springsnail is ovoviviparous, meaning that it produces free-living young (New Mexico Department of Game and Fish, 1988: B-306). Fertilized eggs hatch and develop in the anterior mantle (or pallial oviduct) of female Koster's springsnail (Thorp and Covich, 201: 299-300). Both Roswell springsnail and Koster's springsnail are annual species (Thorp and Covich, 2001: 304), having a life cycle of about one year (Noel, 1954: 127; Taylor, 1985: 16; New Mexico Department of Game and Fish, 1988). Peak densities of Roswell springsnail occur in winter (Noel, 1954: 127).

[6] Dioecious means that individuals possess either male or female reproductive systems, as opposed to monoecious, which means that both male and female reproductive systems are present in the same individual.

Pecos assiminea is oviparous, laying its eggs in gelatinous masses (New Mexico Department of Game and Fish, 1988: B-295). Sada (2001) found that reproduction occurred several times during the year in a similar species, *Assiminea infima*, in Death Valley, California. Parthenogenesis (*i.e.*, sexual reproduction where egg development occurs without fertilization), documented in other similar snails that occupy isolated habitats (Vail, 1978), is not known to occur in Roswell springsnail, Koster's springsnail, or Pecos assiminea.

Amphipods are typically annual species and produce a single brood of young during their life cycle (Smith, 2001: 573; Thorp and Covich, 2001: 794). Noel's amphipod appears to mate in spring, with peak numbers occurring in late fall and early winter (Noel, 1954: 125). Females carry fertilized eggs in a marsupium, or pouch. Eggs develop over a period of one to three weeks (Smith, 2001: 573). After hatching, young are retained in the marsupium for another one to eight days before being released. Brood size may range from several to more than 50 eggs (Smith, 2001: 573; Thorp and Covich, 2001: 795).

1.4.2.4 Habitat Both Koster's springsnail and Roswell springsnail are in the Family Hydrobiidae. All eight described hydrobiids of New Mexico (Taylor, 1987) are state endemics that typically occur in small, geographically isolated habitats consisting of eurythermal (*i.e.*, fluctuating temperature) springs and spring-fed wetland systems restricted to the southern half of the state (Lang, 1998: B77). Habitat of Koster's springsnail consists of soft substrates of springs and seeps (Taylor, 1987: 47). In Bitter Creek, Lang (1998: 13) found the species to be most abundant in areas with deep organic substrate. Roswell springsnail, on the other hand, was found to be most abundant on hard, gypsum substrate in Sago Spring outflow channels and pools (Lang, 1998: 13).

Both springsnails are found throughout Bitter Creek, which varies in water temperature from the headwaters at Dragonfly Spring to the downstream reaches near the mouth of Bitter Lake. The upstream reaches of Bitter Creek are characterized by a relatively stable temperature regime with a narrow range of fluctuation (Lang, 1998: 15). Water temperature at Dragonfly Spring varied only about 8.3°F from 56.5°F to 64.8°F from October 1996 through June 1998 (Lang, 1998: 16). Water temperature was much more variable during the same period in the lower reach of Bitter Creek, ranging from 32°F to 87.8°F. Water temperature regimes are similar in the Sago Spring complex as in Bitter Creek (Lang, 1998: 15). Water temperature varied about 6.3°F, from 62.6°F to 68.9°F at the headspring of Sago Spring and about 10.9°F from 60.3°F to 71.2°F in the outflow at Sago Spring (Lang, 1998: 20-21). Salinity in Bitter Creek ranged from about 4.5 parts per thousand (ppt) to near 6 ppt. Dissolved oxygen in Bitter Creek ranged from about 1.0 parts per million (ppm) to over 20 ppm from 1995 to 1998, with lowest levels occurring in summer evening hours and highest levels during daytime hours in spring. Variation in *p*H was from about 6.67 to 8.20 (Lang, 1998: 22-24).

Taylor (1987: 9) described the habitat of Pecos assiminea as "moist earth beside seepages or spring-brooks; never beside standing water" and that they occurred "beneath salt grass or sedges, less often on exposed surfaces." Lang (2002: A5) reported that Pecos assiminea was closely associated with wetland habitats characterized by soils saturated at the surface and vegetation dominated by American three-square (*Scirpus americanus*), common reed (*Phragmites australis*), and spike rush (*Eleocharis* spp.) with inland saltgrass (*Distichlis spicata*) and rushes (*Juncus* spp.) also occurring as common species in the wetland plant community. The snail typically occurs near the surface of the soil beneath dead plant material and vegetation in these habitats. Pecos assiminea occupies wetland habitats along the margin of Bitter Creek, particularly near the mouth at Bitter Lake, the springs on the west side of Unit 7, and at Sinkhole No. 32 at the lower end of the Sago Spring complex, where the species is most abundant. Although Pecos assiminea is most common in non-inundated wetland habitat, it may also rarely occur in aquatic habitats of Bitter

Creek and Sago Spring (Lang, 1998: 13). The snail was found at a density of about 5.95/ft$^2$ in water depths ranging from 0.06 inches to 8.27 inches in these aquatic habitats (Lang, 1998: 13). The species does not appear to persist in conditions of fluctuating water level or standing water in wetlands that is subject to winter freezing (Lang, 2000: A2).

Gammarid amphipods typically are found in shallow, cool, well-oxygenated waters of small streams, ponds, ditches, sloughs and springs (Holsinger, 1976: 3; Smith, 2001: 574). Amphipods in general require high dissolved oxygen concentrations and relatively high calcium concentration (Smith, 2001: 574). Acidity is a limiting factor for amphipods, with a *p*H of 6.0 generally constituting a lower threshold and 8.0 an upper threshold (Smith, 2001: 574). They are found beneath stones and in aquatic vegetation during daylight hours (Cole, 1988*a*: 5; Smith, 2001: 572-574). Noel's amphipod was found mainly on rubble and rubble-sand substrate at Lander Springbrook and less frequently on silt substrate or vegetation (Noel, 1954: 124). Habitats on Bitter Lake National Wildlife Refuge range from dense beds of emergent aquatic vegetation to clear, flowing spring brooks with submerged aquatic vegetation, vegetated banks and margins, and clean substrates. Standing water and silt accumulation appear to constitute unsuitable habitat for the species (Lang, 2000: A1). Lang (2002: A2) reported that the addition of stones to spring brook habitat, which increased stream gradient and current velocity, improved habitat for Noel's amphipod along the western boundary of Unit 6. Salinity in habitats occupied by *Gammarus-pecos* amphipods is low to moderate, ranging from 0.12 to 5.85 ppt (Cole, 1988a: 5). Cole (1981: 27) reported chemical composition of the water at North Spring to be similar to that described at Lander Springbrook (Noel, 1954: 123): impure gypsum substrate, sulfate- and chloride-rich waters, and calcium as the primary cation.

## 1.5 Permits Required for Implementation

No permits are required for revised critical habitat designation. Designation of critical habitat occurs through a rule-making process under the Administrative Procedures Act and the ESA.

## 1.6 Related Laws, Authorizations, and Plans

The August 2005 final listing rule for the four invertebrates included designation of 396.5 acres of critical habitat for Pecos assiminea in the Diamond Y Spring and East Sandia Spring (70 FR 46304).

The Nature Conservancy manages lands they own consistent with their mission statement, which is to "preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive." Site-specific management plans have not yet been developed for the Diamond Y Spring or Sandia Springs preserves (J. Karges, The Nature Conservancy, pers. comm., 1 April 2010).

Related provisions of the ESA require federal agencies to consult with the Service when there are potential effects to endangered or threatened species, independent of critical habitat. The four invertebrate species co-occur with other federal-listed species including Pecos gambusia (*Gambusia nobilis*), Leon Springs pupfish (*Cyprinodon bovinus*), Comanche Springs pupfish (*Cyprinodon elegans*), and Pecos sunflower (*Helianthus paradoxus*), for which recovery plans have been developed. Critical habitat was designated for Leon Springs pupfish in 1980 (45 FR 54678), which encompasses the proposed Diamond Y Springs critical habitat unit.

The National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge Improvement Act of 1997, provides statutory authority for management of national wildlife refuges. The National Wildlife Refuge System Administration Act established that the mission of the National Wildlife Refuge System is wildlife conservation, which includes restoration and maintenance of biological integrity, diversity, and environmental health. Management of the Bitter Lake National Wildlife Refuge is conducted in accordance with the U.S. Fish and Wildlife Service Manual (parts 601-603). A comprehensive conservation plan for Bitter Lake National Wildlife Refuge was completed in 1998 (Service, 1998*a*).

A conservation plan for the four invertebrate species was developed by the New Mexico Department of Game and Fish (2005). The plan contains recommendations for habitat management, as the New Mexico Wildlife Conservation Act does not include any regulatory authority other than precluding direct take of state-listed endangered species (State of New Mexico, 2002: 9).

## 1.7 Issues

Issues are defined as concerns about the potential effects of the proposed action. Issues associated with designation of critical habitat were identified in written and recorded oral comments received during the public comment period on the February 2002 proposed rule to list the list the four invertebrate species with critical habitat (67 FR 6459) that was reopened in May 2005 for additional public comment (70 FR 23083), and final listing rule with critical habitat (70 FR 46304). Comments generally fell into three categories: 1) biological concerns; 2) procedural and legal compliance; and 3) National Environmental Policy Act (NEPA) compliance and economic analysis (70 FR 46304). Of 33 comments, 22 were not related directly to potential effects of the proposed action and, therefore, are not considered to be issues. Remaining comments from the public related to potential (real or perceived) effects of the proposed action are summarized into five issues:

- Critical habitat designation may or may not contribute to conservation of the four invertebrate species; all known populations of the four invertebrates were not considered in the previous critical habitat designation (70 FR 46304).

- Critical habitat designation may lead to restrictions on ground water pumping in the Pecos basin, delivery of irrigation water, or water deliveries to meet interstate compact agreements.

- Critical habitat designation may result in restrictions on oil and gas development in locations where surface or ground water is connected to habitats occupied by the four invertebrate species.

- Critical habitat designation may lead to restrictions on use of herbicides to control or manage salt cedar (*Tamarix chinensis*) in the project area.

- Designation of critical habitat may be beneficial or detrimental to the local economy.

On 22 June 2010, a revised proposed rule and associated EA were released for public comment until 23 August 2010. A peer review was also conducted during this period. Four responses to the proposed rule were received from agencies and organizations, and two peer reviewers provided comments. The following significant comments were made:

- The proposed critical habitat, while essential for survival of the species, is insufficient to increase the species' numbers and viability as it only includes currently-occupied habitat. Degraded habitats need to be restored to allow for increases in population.

- Limit critical habitat designation on Bitter Lake National Wildlife Refuge to habitat suitable for the species. Designation of other areas outside of suitable habitat would unnecessary hamper management efforts for other species (e.g. waterfowl).

- Requests clarification that all proposed critical habitat includes all sites identified by Lang (2010).

- Recommends designation of additional critical habitat for Noel's amphipod and Pecos assiminea in the South Tract of Bitter Lake National Wildlife Refuge.

# 2.0 ALTERNATIVES, INCLUDING THE NO ACTION ALTERNATIVE

## 2.1 Development of Alternatives

Identification of areas essential for the conservation of the four invertebrate species is the cornerstone of critical habitat designation. The Service made an assessment of areas needed for the conservation of the four invertebrate species based on the best scientific and commercial information available concerning the present and historic range of the four species, their habitat and biology, and threats. This assessment and issues identified during comments on the previous proposed critical habitat rule (70 FR 46304: 46306-46311), as well as the complaint challenging the 2005 critical habitat designation, served as the basis for developing critical habitat revision alternatives.

## 2.2 Alternative A - No Action

The No Action alternative is defined as no new designation of critical habitat for any of the four invertebrate species. The existing 396.4 acres of critical habitat for Pecos assiminea in west Texas, which were designated in August 2005 (70 FR 46304), would remain in place. Analysis of the No Action alternative is required by NEPA, and it serves as a baseline for analyzing effects of action alternatives.

## 2.3 Alternative B - Proposed Action

The proposed action would designate approximately 521.3 acres of critical habitat for the four invertebrate species (Table 1). This alternative proposes two critical habitat units for Roswell springsnail, Koster's springsnail, Noel's amphipod, and Pecos assiminea, encompassing 70.6 acres (Table 1). Both of these units - the Sago/Bitter Creek Complex (Figure 4) and Impoundment Complex (Figure 5) - are located in Chaves County, New Mexico, primarily within the Middle Tract of Bitter Lake National Wildlife Refuge. A total of 74.1 acres are located within the Middle Tract of Bitter Lake National Wildlife Refuge (Table 1), including 31.9 acres in Unit 1 and 36.4 acres in Unit 2 (Table 1). The remaining 2.8 acres of Unit 2 consist of land owned by the City of Roswell (Table 1, Figure 5).

Alternative B also proposes a third critical habitat unit solely for Noel's amphipod. This unit, denoted as the Rio Hondo (Unit 3, Figure 6), encompasses 5.8 acres along the Rio Hondo on the South Tract of Bitter Lake National Wildlife Refuge. Two additional critical habitat units are proposed solely for Pecos assiminea. These are the Diamond Y Spring Complex in Pecos County, Texas (Unit 4, Figure 7) and East Sandia Spring in Reeves County, Texas (Unit 5, Figure 8). These units, encompassing 441.4 and 3.0 acres, respectively, are located on private lands owned by The Nature Conservancy (Table 1). Detailed descriptions of the five proposed critical habitat units follow.

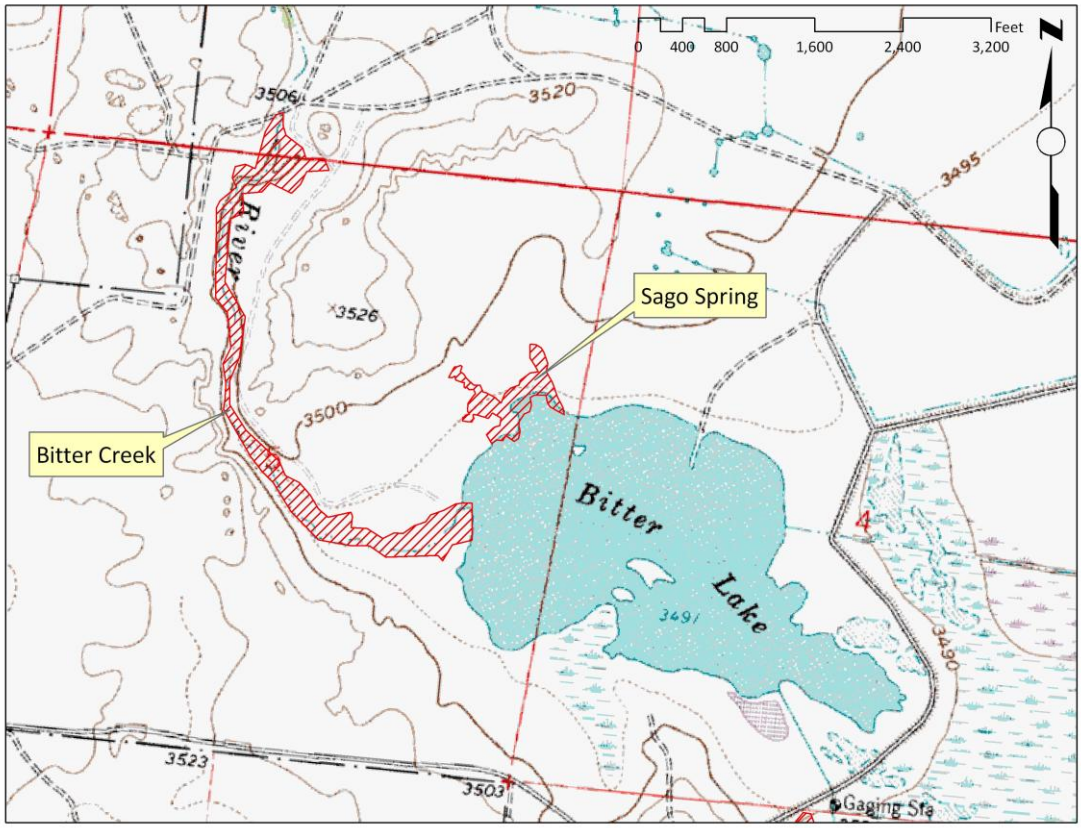
**Table 1**. Critical habitat acreage proposed for the four invertebrate species by critical habitat unit and landownership.

| CRITICAL HABITAT UNIT | LAND OWNERSHIP | | | |
|---|---|---|---|---|
| | U.S. Fish and Wildlife Service (acres) | The Nature Conservancy (acres) | City of Roswell (acres) | Total (acres) |
| UNIT 1: Sago/Bitter Creek Complex | 31.9 | 0 | 0 | 31.9 |
| UNIT 2: Impoundment Complex | 36.4 | 0 | 2.8 | 39.2 |
| UNIT 3: Rio Hondo | 5.8 | 0 | 0 | 5.8 |
| UNIT 4: Diamond Y Spring Complex | 0 | 441.4 | 0 | 441.4 |
| Unit 5: East Sandia Spring | 0 | 3.0 | 0 | 3.0 |
| **TOTAL** | 74.1 | 444.4 | 2.8 | 521.3 |

2.3.1 Unit 1 - Sago/Bitter Creek Complex , Bitter Lake National Wildlife Refuge, Chaves County, New Mexico Unit 1 consists of 31.9 acres of habitat that was occupied by all four invertebrates at the time of listing and that remains occupied at the present time. This unit is proposed to be designated for all four species and contains all of the features essential to the conservation of these species. Unit 1 is located on the northern portion of the Middle Tract of Bitter Lake National Wildlife Refuge in Chaves County, New Mexico (Figure 4).

The gypsum sinkholes adjacent to Sago Spring and Bitter Creek comprise the core population center for all four species. The proposed designation includes all springs, seeps, sinkholes, and outflows surrounding Bitter Creek and the Sago Springs complex. Habitat in this unit is threatened by subsurface drilling or similar activities that may contaminate surface water drainages or aquifer water. Habitat in the unit is also threatened by wildfire, nonnative fish, nonnative crayfish, nonnative snails, nonnative vegetation, and unauthorized activities including dumping of pollutants or fill material into occupied sites. Therefore, primary constituent elements in this unit may require special management considerations or protection to minimize impacts resulting from these threats. The entire unit is located on lands owned and managed by the Service.

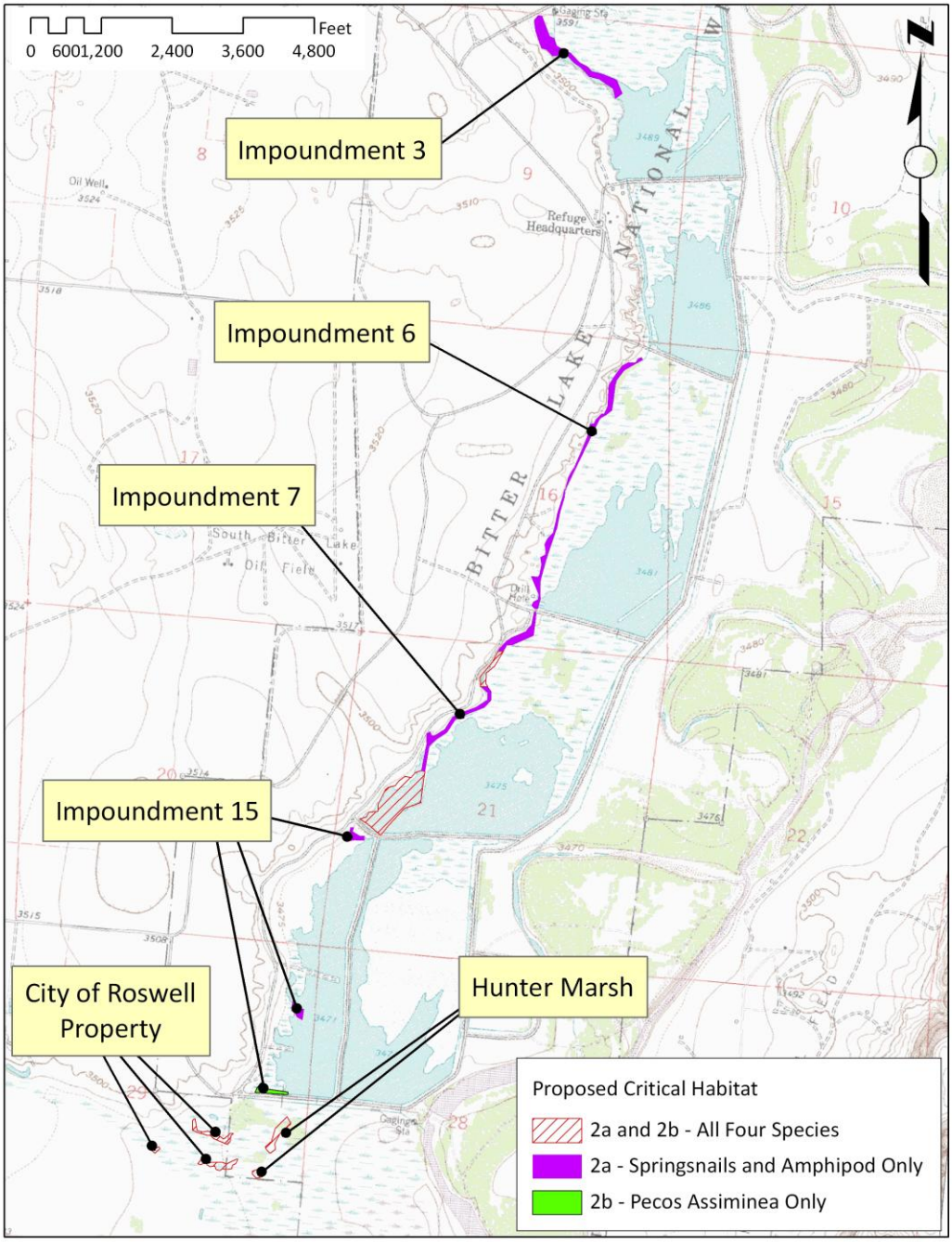
**Figure 4**. Critical Habitat Unit 1: Sago/Bitter Creek Complex. This unit is located in the Middle Tract of Bitter Lake National Wildlife Refuge in Chaves County, New Mexico, and encompasses 31.9 acres. See Figure 1 for location map.



2.3.2 Unit 2 - Impoundment Complex , Bitter Lake National Wildlife Refuge and City of Roswell, Chaves County, New Mexico This unit consists of 39.2 acres of habitat that was occupied by the four invertebrates at the time of listing and that remains occupied at the present time. This unit is proposed to be designated for all four species and contains all of the features essential to the conservation of these species. Unit 2 is located on the southern portion of the Middle Tract of Bitter Lake National Wildlife Refuge and on property owned by the city of Roswell, Chaves County, New Mexico, and includes portions of waterfowl management unit impoundments 3, 6, 7, and 15, and Hunter Marsh (Figure 5).

This unit comprises a secondary population center for all four invertebrates. The proposed designation includes all springs, seeps, sinkholes, and outflows surrounding the refuge impoundments. Habitat in this unit is threatened by subsurface drilling or similar activities that may contaminate surface water drainages or aquifer water. Habitat in the unit is also threatened by wildfire, nonnative fish, nonnative crayfish, nonnative snails, nonnative vegetation, and unauthorized activities including dumping of pollutants or fill material into occupied sites. Therefore, the primary constituent elements in this unit may require special management considerations or protection to minimize impacts resulting from these threats. Land ownership in this unit includes the Service and the City of Roswell (Table 1).

**Figure 5**. Critical Habitat Unit 2: Impoundment Complex. This unit, encompassing 39.2 acres, is located in the Middle Tract of Bitter Lake National Wildlife Refuge (36.4 acres) and City of Roswell land (2.8 acres) in Chaves County, New Mexico. See Figure 1 for location map.



2.3.3 Unit 3 - Rio Hondo , Bitter Lake National Wildlife Refuge, Chaves County, New Mexico
The Rio Hondo Unit consists of 5.8 acres along a 0.4-mile segment of the Rio Hondo on the South of Bitter Lake National Wildlife Refuge (Figure 6). Proposed critical habitat for Noel's amphipod along the Rio Hondo on the South Tract of Bitter Lake National Wildlife Refuge was known to be occupied by a species of amphipod from collections made there in 2006. Specimens collected from the site in 2006 through 2009 were subsequently analyzed and in 2010 were found to be Noel's amphipod (Berg, 2010; Lang, 2010). In all likelihood, then, Noel's amphipod occurred at the Rio Hondo site in 2005, when the species was listed. Proposed critical habitat in this unit consists of a series of springs and seeps along the bank of the Rio Hondo.

Habitat in Unit 3 is threatened by subsurface drilling or similar activities that may contaminate surface drainage or aquifer water, chemical fertilizers and pesticides applied to adjacent farmland, contaminants in the Rio Hondo from upstream sources, fire, unauthorized activities (*e.g.* dumping of pollutants or fill material into occupied sites), and nonnative species including crayfish, snails and vegetation. Therefore, primary constituent elements in this unit may require special management considerations or protection to minimize impacts resulting from these threats. The entire unit is located on lands owned and managed by the Service.

2.3.4 Unit 4 - Diamond Y Spring Complex , Pecos County, Texas This unit comprises a major population of Pecos assiminea and contains all of the features essential to the conservation of the species. This unit is proposed to be designated for Pecos assiminea only and was occupied at the time of listing. The designation includes 441.4 acres and consists of Diamond Y Spring and approximately 4.2 miles of its outflow in Diamond Y Draw, ending approximately 0.5 miles downstream from the State Highway 18 bridge crossing in Pecos County, Texas. Also included in Unit 4 is approximately 0.5 miles of Leon Creek upstream from the confluence with Diamond Y Draw (Figure 7).

The boundary of Unit 4 did not change from the final critical habitat designation in 2005 (70 FR 46304: 46323) but the acreage was recalculated, which resulted in a change from 380 acres in the 2005 final rule to 441.4 acres in this proposed action. All surrounding riparian vegetation and mesic soil environments within the spring, outflow, and portion of Leon Creek are proposed for critical habitat designation because these areas are considered suitable habitat for Pecos assiminea. Habitat in Unit 4 is threatened by increased groundwater pumping, subsurface drilling or similar activities that may contaminate surface drainage or aquifer water, wildfire, and nonnative species (*i.e.* fish, crayfish, snails, vegetation). This unit occurs entirely on private lands owned and managed by The Nature Conservancy as the Diamond Y Spring Preserve.

2.3.5 Unit 5 - East Sandia Spring , Reeves County, Texas East Sandia Spring is at the base of the Davis Mountains just east of Balmorhea, Texas, and is part of the San Solomon-Balmorhea Spring Complex, the largest remaining desert spring system in Texas where the Pecos assiminea is found. This unit is proposed to be designated for Pecos assiminea only and was occupied at the time of listing. The designation includes the springhead itself, surrounding seeps, and all submergent vegetation and moist soil habitat found at the margins of these areas, comprising the primary constituent elements for the Pecos assiminea. This designation is approximately 3.0 acres of aquatic and neighboring upland habitat (Figure 8). Habitat in Unit 5 (East Sandia Spring) is threatened by increased groundwater pumping, wildfire, and nonnative species including fish, crayfish, snails, and vegetation (Karges, 2003: 145). This unit is within in a 240-acre preserve owned and managed by The Nature Conservancy.

**Figure 6**. Critical Habitat Unit 3: Rio Hondo. This unit, encompassing 5.8 acres, is located in the South Tract of Bitter Lake National Wildlife Refuge in Chaves County, New Mexico. See Figure 1 for location map.

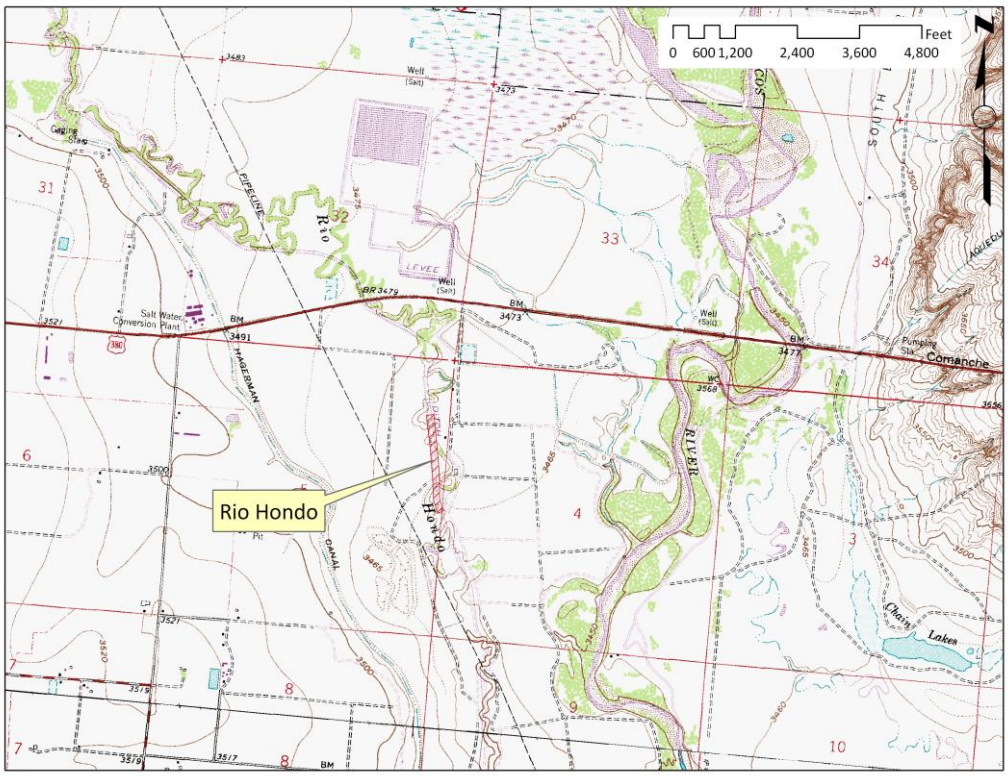


**Figure 7**. Critical Habitat Unit 4: Diamond Y Spring Complex. This unit, consisting of 441.4 acres, is located entirely on The Nature Conservancy's Diamond Y Spring Preserve in Pecos County, Texas. See Figure 1 for location map.

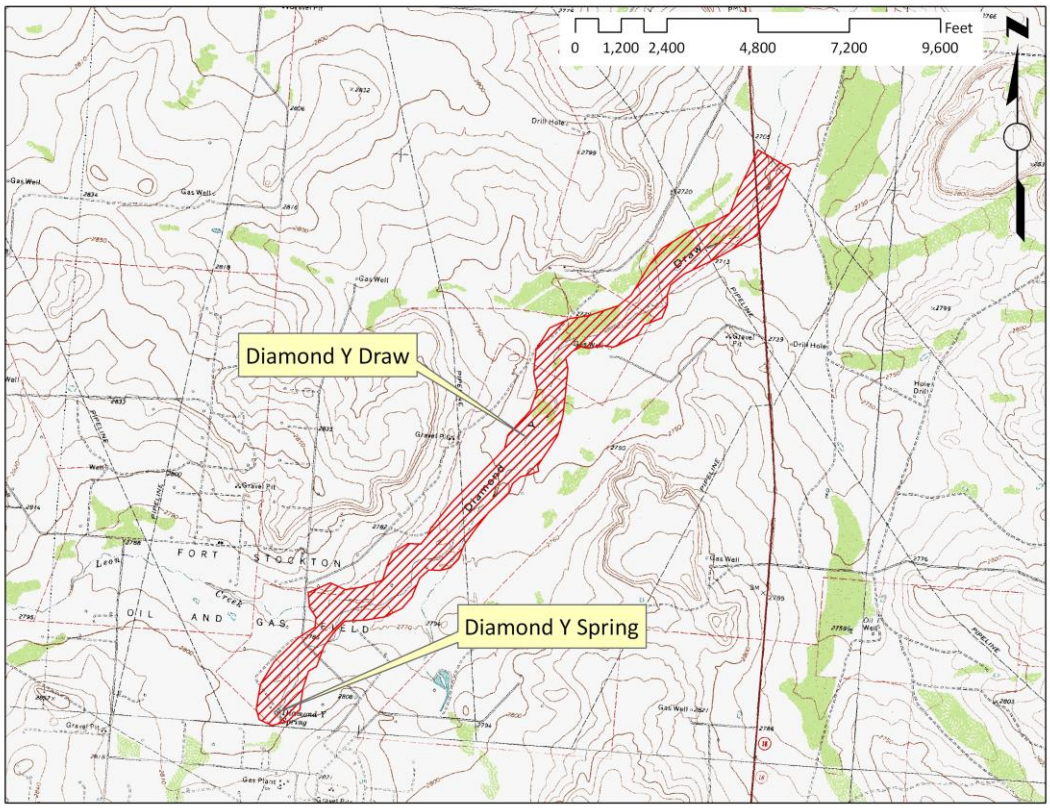
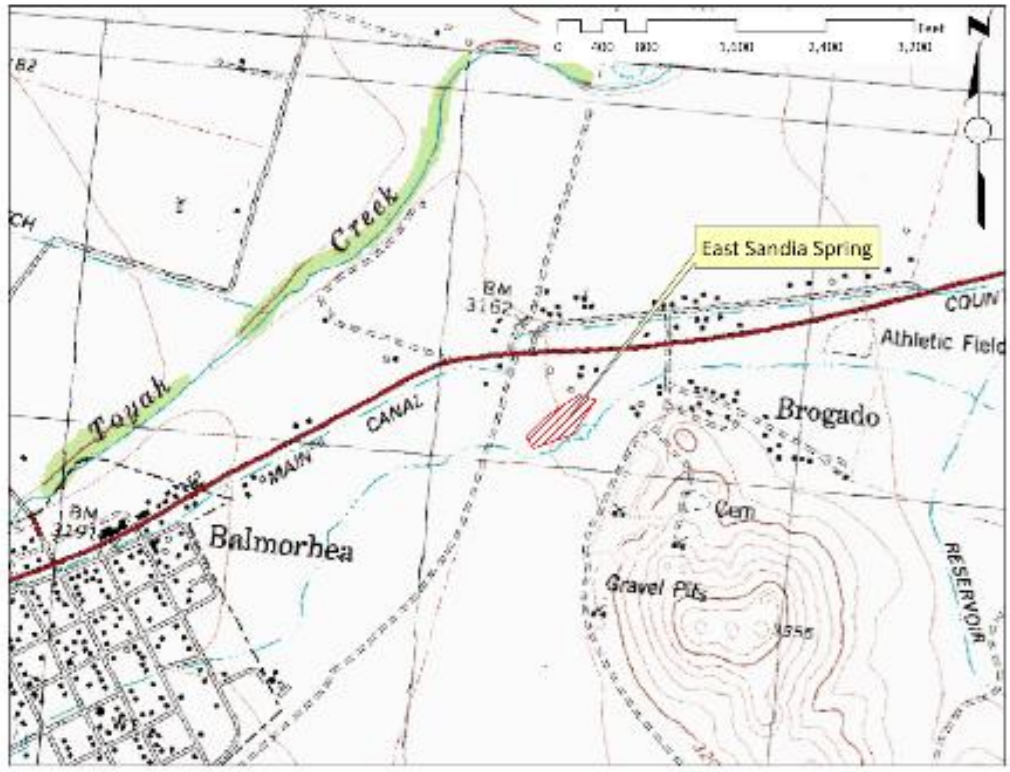


**Figure 8**. Critical Habitat Unit 5: East Sandia Spring. This unit, encompassing 3.0 acres, is located entirely on lands owned by The Nature Conservancy in Reeves County, Texas. See Figure 1 for location map.



# 2.4 Comparison of Alternatives

Table 2 summarizes the potential effects or characteristics of the alternative critical habitat designations on the environment. Potential effects on resources are summarized from the analyses presented in Chapter 3.

**Table 2**. Comparison of potential effects of alternative critical habitat designations, as compared to existing conditions, by resource category.

| Resource Category | Alternative A - No Action | Alternative B - Proposed Action |
|---|---|---|
| Critical Habitat Area | 396.5 acres | 521.3 acres |
| Conservation of the Four Invertebrate Species | - §7 consultation on potential effects of proposed federal actions on the four invertebrate species under the jeopardy standard<br><br>- No §7 consultation on potential effects to critical habitat under the destruction or adverse modification standard except at Diamond Y Spring and East Sandia Spring for Pecos assiminea<br><br>- Non-regulatory or educational benefits from critical habitat designation may not occur except for Pecos assiminea at Diamond Y Spring and East Sandia Spring | - §7 consultation on potential effects to critical habitat under the destruction or adverse modification standard for federal actions would ensure that habitat essential for conservation of the species retains its suitability<br><br>- Non-regulatory and educational benefits to conservation of the four invertebrate species would occur, including informing the public of areas important for conservation of the species, and focusing attention on and awareness of those areas |
| Water Resources | - §7 consultation on effects to the four invertebrate species under the jeopardy standard and to Pecos assiminea critical habitat at Diamond Y Spring and East Sandia Spring under the adverse modification standard would be required for water projects with a federal nexus<br><br>- Water projects with a federal nexus that could substantially reduce or eliminate flow from springs, seeps, outflow channels, or wetlands inhabited by any of the four invertebrate species would likely trigger formal consultation under the jeopardy standard for the four invertebrate species as well as other species that are already listed under the Act<br><br>- State regulation of water resources in the Roswell basin would prevent substantial, sustained draw-down of the groundwater sources that support the springs in the Middle Tract of Bitter Lake National Wildlife Refuge that are inhabited by the four invertebrate species | - §7 consultation on effects to the four invertebrate species under both the jeopardy and adverse modification/destruction of critical habitat standards would be required for federal actions in all four critical habitat units<br><br>- Minor changes in water projects with a federal nexus through section 7 consultation may occur in the form of additional conservation recommendations to reduce impacts to primary constituent elements<br><br>- Substantive changes to reasonable and prudent alternatives developed under the jeopardy standard for water projects with a federal nexus would not be likely to occur with addition of critical habitat designation for the four invertebrates |

Table 2, continued

| Resource Category | Alternative A - No Action | Alternative B - Proposed Action |
|---|---|---|
| Oil and Gas | - §7 consultation on effects to the four invertebrate species under the jeopardy standard and to Pecos assiminea critical habitat at Diamond Y Spring and East Sandia Spring under the adverse modification standard would be required for federal actions<br><br>- Oil and gas project with federal involvement are in the Bitter Lake National Wildlife Refuge area are already subject to stipulations for protecting groundwater<br><br>- Potential for additional requirements on oil and gas well development on federal lands is low | - §7 consultation on effects to the four invertebrate species under both the jeopardy and adverse modification/destruction of critical habitat standards in all four units would be required for federal actions<br><br>- Minor changes through section 7 consultation in oil and gas projects that have a federal nexus may occur in the form of additional conservation recommendations to reduce impacts to primary constituent elements<br><br>- Substantive changes to reasonable and prudent alternatives developed under the jeopardy standard for oil and gas projects with a federal nexus would not be likely to occur with addition of critical habitat designation |
| Land Management | - §7 consultation on effects to the four invertebrate species under the jeopardy standard and to Pecos assiminea critical habitat at Diamond Y Spring and East Sandia Spring under the adverse modification standard would be required for federal actions<br><br>- Land management activities conducted on Bitter Lake National Wildlife Refuge, adjacent City of Roswell land, the Diamond Y Springs Preserve, or the Sandia Springs Preserve would continue to be implemented as they have in the recent past | - §7 consultation on effects to the four invertebrate species under both the jeopardy and adverse modification/destruction of critical habitat standards in all four units would be required for federal actions<br><br>- No substantive changes would occur in land management activities conducted on the Middle Tract of Bitter Lake National Wildlife Refuge, City of Roswell property, the Diamond Y Springs Preserve, or the Sandia Springs Preserve compared to the No Action alternative<br><br>- Farmed acreage on the South Tract of Bitter Lake National Wildlife Refuge may be reduced slightly due to required buffers around designated critical habitat. |
| Livestock Grazing and Dairy Operations | - §7 consultation on effects to the four invertebrate species under the jeopardy standard and to Pecos assiminea critical habitat at Diamond Y Spring and East Sandia Spring under the adverse modification standard would be required for federal actions | - §7 consultation on effects to the four invertebrate species under both the jeopardy and adverse modification/destruction of critical habitat standards would be required for federal actions in all four units<br><br>- Minor changes in livestock grazing and dairy operations that have a federal nexus through section 7 consultation may occur in the form of additional conservation recommendations to reduce impacts to primary constituent elements<br><br>- Substantive changes to reasonable and prudent alternatives developed under the jeopardy standard for federal actions related to livestock grazing and dairy operations would not be likely to occur with addition of critical habitat designation |

Table 2, continued

| Resource Category | Alternative A - No Action | Alternative B - Proposed Action |
|---|---|---|
| Roswell Wastewater Treatment Facility | - §7 consultation on potential effects of effluent discharge on Noel's amphipod population along Rio Hondo under the jeopardy standard may be required for reissuance of NPDES permit<br><br>- modification of current operations of facility are unlikely because Noel's amphipod resides in springs and seeps that are only infrequently inundated by the river and effluent limits are protective of aquatic life | - §7 consultation on potential effects of effluent discharge, if conducted, would also have to consider potential effects on critical habitat of Noel's amphipod in Unit 3: Rio Hondo<br><br>- critical habitat considerations would be unlikely to alter results of consultation conducted under the jeopardy standard alone |
| Recreation | - §7 consultation on effects to the four invertebrate species under the jeopardy standard and to Pecos assiminea critical habitat at Diamond Y Spring and East Sandia Spring under the adverse modification standard would be required for federal actions<br><br>- Management actions related to recreation on Bitter Lake National Wildlife Refuge and The Nature Conservancy preserves would not change | - §7 consultation on effects to the four invertebrate species under both the jeopardy and adverse modification/destruction of critical habitat standards would be required for federal actions in all four units<br><br>- No additional effects on recreation actions compared to No Action alternative |
| Socioeconomic Conditions and Environmental Justice | - §7 consultation on effects to the four invertebrates under the jeopardy standard and to Pecos assiminea critical habitat at Diamond Y Spring and East Sandia Spring under the adverse modification standard would be required for federal actions<br><br>- Actions on private lands that have the potential to result in take of any of the four invertebrate species would be subject to section 10 of the ESA, which requires development of a Habitat Conservation Plan as part of an application to the Service for an incidental take permit | - §7 consultation on effects to the four invertebrate species under both the jeopardy and adverse modification/destruction of critical habitat standards would be required for federal actions in all four units<br><br>- Economic impacts due to critical habitat designation alone would result from additional effort required by federal agency staff to include critical habitat considerations in section 7 consultations. These impacts are estimated at $5,900 per year.<br><br>- Other economic impacts, such as special requirements for oil and gas well development in the Habitat Protection Zone and habitat management activities by The Nature Conservancy, would occur regardless of critical habitat designation |

# 3.0 AFFECTED ENVIRONMENT & ENVIRONMENTAL CONSEQUENCES

This chapter describes aspects of the environment that may potentially be affected by revising the critical habitat designation for the four invertebrate species in New Mexico and Texas. Potential effects of revised critical habitat designation under each alternative are described for the various resource categories. Resource categories addressed in the analysis were selected based on projects that have triggered section 7 consultation in the past, issues identified during the public comment period on the proposed rule (*cf.* section 1.7), and conservation considerations for the four invertebrate species. Critical habitat designation may have effects on conservation of the four invertebrate species and various land uses or activities that have a federal nexus (*e.g.* land uses or activities that are proposed by a federal agency, require federal permitting, or are federal funded).

## 3.1 Assessment of Impacts

### 3.1.1 Nature of Impacts from Critical Habitat Designation

Impacts on the environment from designation of critical habitat stem from the section 7 consultation requirements of the ESA (*cf.* section 1.4.1.2). Under section 7(a)(2) of the ESA, federal agencies are required to consult with the Service on actions that they fund, implement, or authorize, which may affect listed species or critical habitat (50 CFR §402). The purpose of section 7 consultation, with respect to critical habitat, is to ensure that the actions of federal agencies do not destroy or adversely modify critical habitat. Critical habitat is defined as habitat that is essential for the conservation of a listed species.

*Critical habitat designation does not have any impact on the environment other than through the ESA section 7 consultation process conducted for federal actions. Private actions that have no federal involvement are not affected by critical habitat designation.*

Critical habitat designation does not have any impact on the environment other than through the section 7 consultation process. Critical habitat designation alone does not establish blanket rules or restrictions on land use, nor does it automatically prohibit or modify any activity. Each proposed federal action that may potentially affect designated critical habitat is analyzed individually during the section 7 consultation process. Individuals, organizations, states, local governments, and other non-federal entities are potentially affected by the designation of critical habitat only if their actions occur on federal lands, require a federal permit, license, or other authorization, or involve federal funding.

Separate analyses are made under both the jeopardy and the adverse modification standards. The jeopardy analysis evaluates potential impacts on the species, while the adverse modifications analysis specifically evaluates potential impacts on designated critical habitat. The Ninth Circuit Court determined that there is an additional difference between the two standards. In *Gifford Pinchot Task Force et al. v. United States Fish and Wildlife Service* (2004), the court held that while the jeopardy standard concerns the survival of a species or its risk of extinction, the adverse modification standard concerns the value of critical habitat for the recovery, or eventual delisting, of a species. As pointed out in the Ninth Circuit decision, survival of a species and recovery (or

conservation) of a species are distinct concepts in the ESA. Implementation of the two standards, therefore, involves separate and distinct analyses based on these concepts.

Because of the *Gifford Pinchot* decision, the Service no longer relies on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, the Service relies on the statutory provisions of the Act to complete the analysis with respect to critical habitat. The potential for destruction or adverse modification of critical habitat by a federal action is assessed under the statutory provisions of the ESA by determining whether the effects of the implementation of the proposed federal action would allow the affected critical habitat to remain functional (or retain those PBFs that relate to the ability of the area to periodically support the species) to serve its intended conservation role for the species (75 FR 66519). This analysis provides the basis for determining the significance of anticipated effects of the proposed federal action on critical habitat. The threshold for destruction or adverse modification is evaluated in the context of whether the critical habitat would remain functional to serve the intended conservation role for the species.

Even though the jeopardy and adverse modification standards are different, in the case of the four invertebrate species the results of the application of the jeopardy and adverse modification standards on project modifications are expected to have similar outcomes. The ability of these species to persist is very closely tied to the quality of their habitats. All four invertebrate species have short life spans (approximately one year) and a long breeding season (spring through fall); therefore, population numbers are able to rebound in a relatively short time period. Jeopardy can only occur when there is harm to habitat which would prevent the species from adequately reproducing and reestablishing its population. There is also little chance of a determination of destruction or adverse modification which does not harm members of the species. The Service proposed no unoccupied habitat for expansion of the species because the Service's proposal indicated there was no other historical spring or seep habitat in this area capable of restoration. Instead, all the proposed critical habitat is occupied by the species and any harm to the habitat is likely to also harm the members of the species. Alterations of habitat that diminish the value of the habitat (e.g. flow, water quality, suitability of substrate) and the amount of habitat for the species would be likely to also affect population size, reproduction, and recruitment of the invertebrates, and would therefore, appreciably reduce their likelihood of survival in the wild and constitute jeopardy. Consequently, the reasonable and prudent measures required as a result of section 7 consultations at the proposed critical habitat units may not be materially different when compared to listing of the species alone (Murphy, 2010).

Examples of actions not likely to destroy or adversely modify critical habitat include, but are not limited to, oil and gas exploration in areas where surface or ground water is not connected to proposed critical habitat areas, ground water pumping or use that does not significantly lower aquifer levels or reduce spring discharges, domestic sewer hook-ups to city wastewater treatment facilities within ground water recharge zones of supporting aquifers (67 FR 6459: 6469), and projects implemented in accordance with biological opinions issued by the Service.

Some activities may be considered to be of benefit to the four invertebrate species and, therefore, would not be expected to adversely modify critical habitat when carefully planned. Examples of such beneficial

actions could include re-establishing populations of the four invertebrate species within their historic range, removal and control of salt cedar to improve habitat and hydrologic conditions at springs and seeps, restoration of wetlands, and removal of nonnative species.

### 3.1.2 Overlap With Other Listed Species

All of the proposed critical habitat is currently occupied by at least one other listed aquatic or wetland-associated species. The species include: Pecos gambusia, interior least tern (*Sterna antillarum*), and Pecos sunflower at Unit 1 - Sago/Bitter Creek Complex and Unit 2 - Impoundment Complex at Bitter Lake National Wildlife Refuge; Leon Springs pupfish, Pecos gambusia, and Pecos sunflower at Unit 4 - Diamond Y Spring Complex; Comanche Springs pupfish, Pecos gambusia, and Pecos sunflower at Unit 5 - East Sandia Spring; and Pecos sunflower at Unit 3 - Rio Hondo.

Habitat requirements of listed species that occur in proposed critical habitat overlap with those of the four invertebrate species. Consequently, many of the habitat elements relevant to conservation of the four invertebrate species are currently considered in section 7 consultations. This reduces the probability of there being additional conservation requirements arising from section 7 consultations that include consideration of designated critical habitat for the four invertebrate species.

Critical habitat designated for Pecos sunflower on 1 April 2008 (73 FR 17762) and on 15 August 1980 for Leon Springs pupfish (45 FR 54678) overlaps with proposed critical habitat for the four invertebrate species. There is spatial overlap of designated critical habitat for Pecos sunflower with proposed critical habitat for the four invertebrate species in Unit 1 - Sago/Bitter Creek Complex (Figure 9) and Unit 2 - Impoundment Complex (Figure 10).

In Unit 4 - Diamond Y Spring Complex, proposed critical habitat for the four invertebrate species (Pecos assiminea only) overlaps with designated critical habitat for both Pecos sunflower and Leon Springs pupfish (Figure 11). Designated critical habitat for Pecos sunflower overlaps with proposed critical habitat for Noel's amphipod at Unit 3 - Rio Hondo (Figure 12).

**Figure 9**. Overlap with Pecos sunflower critical habitat in Unit 1.

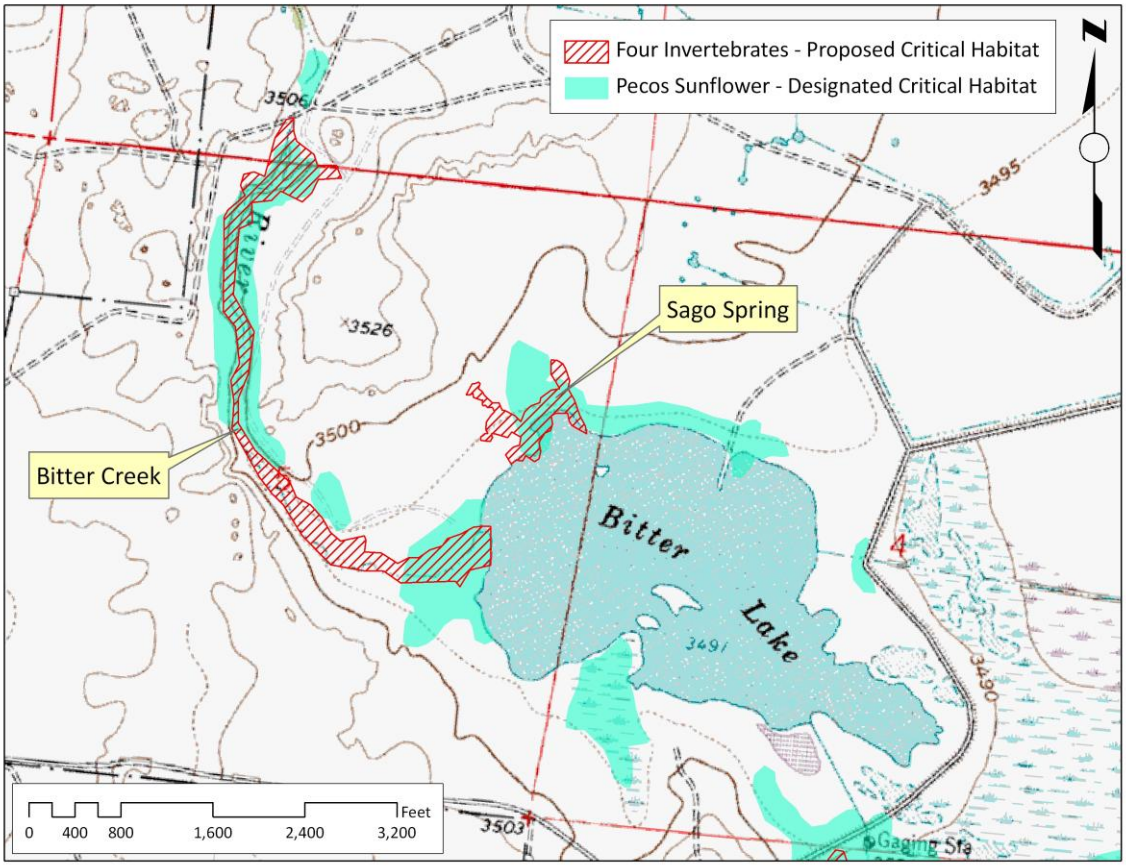


**Figure 10**. Overlap of proposed critical habitat with Pecos sunflower critical habitat in Unit 2.

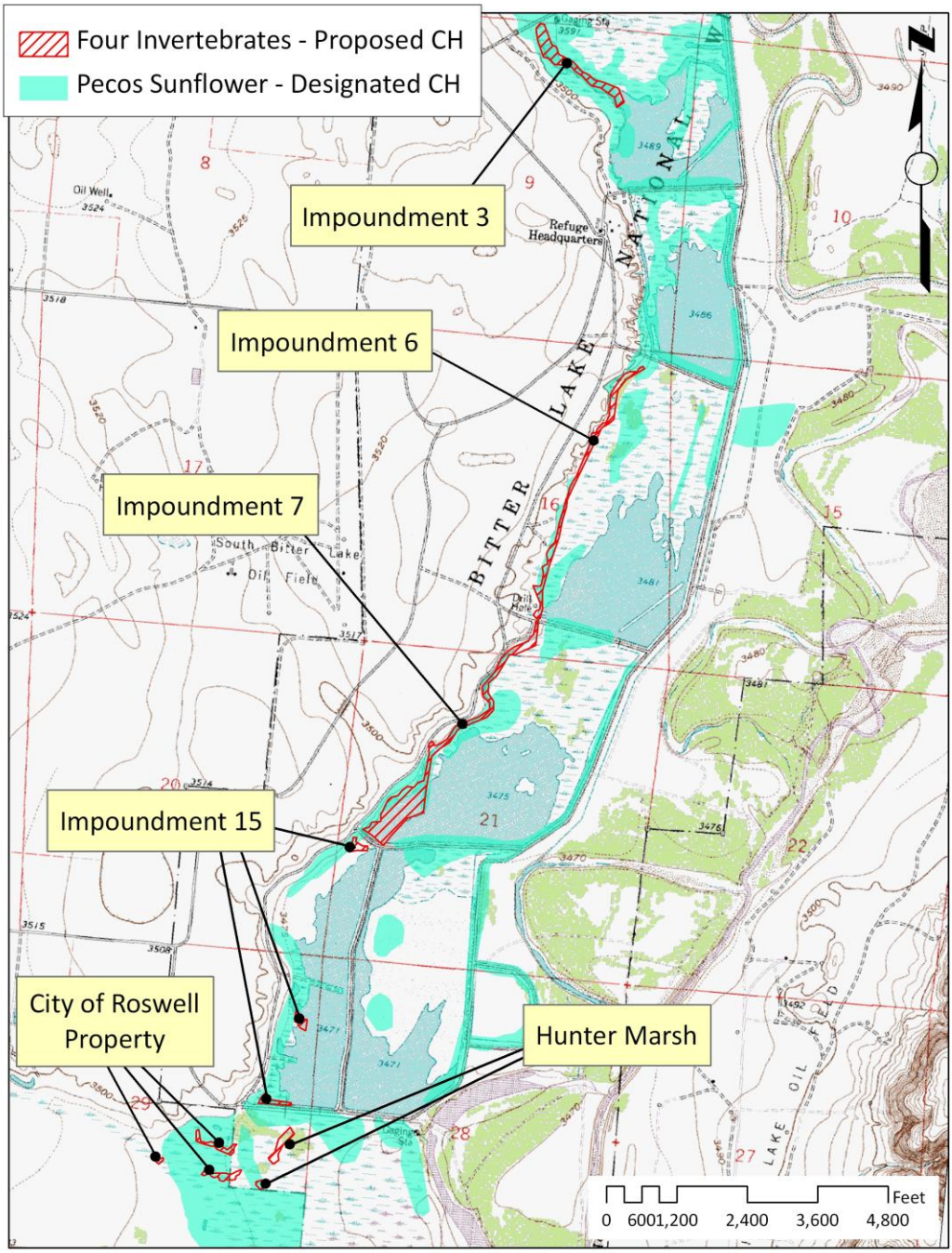


**Figure 11**. Overlap with Leon Springs pupfish and Pecos sunflower critical habitat in Unit 4.

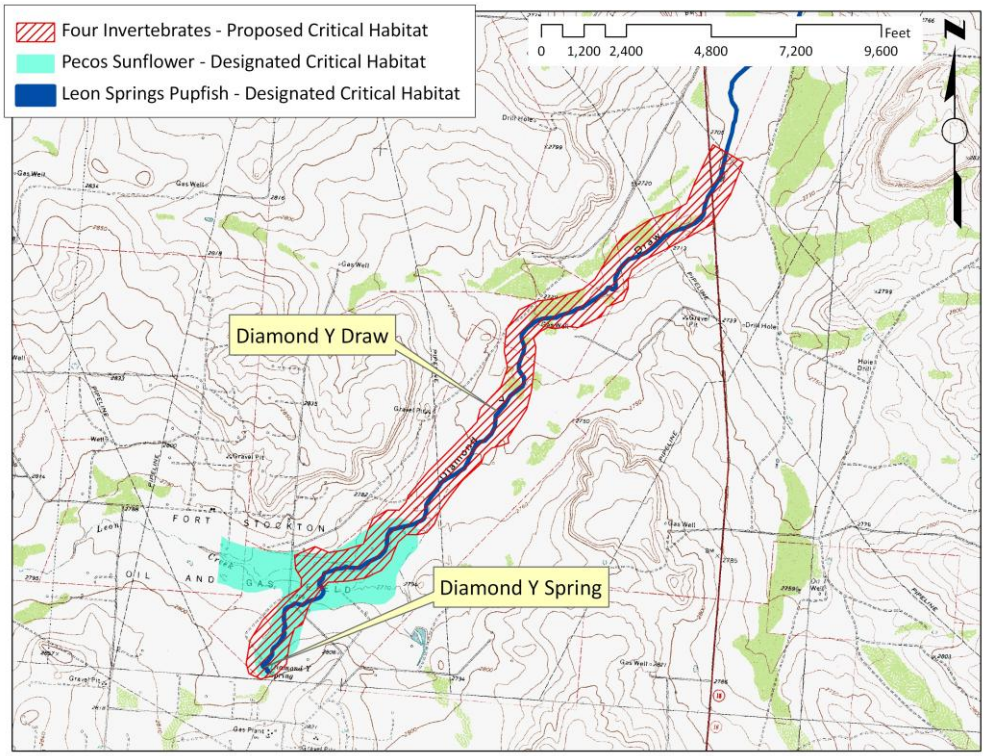
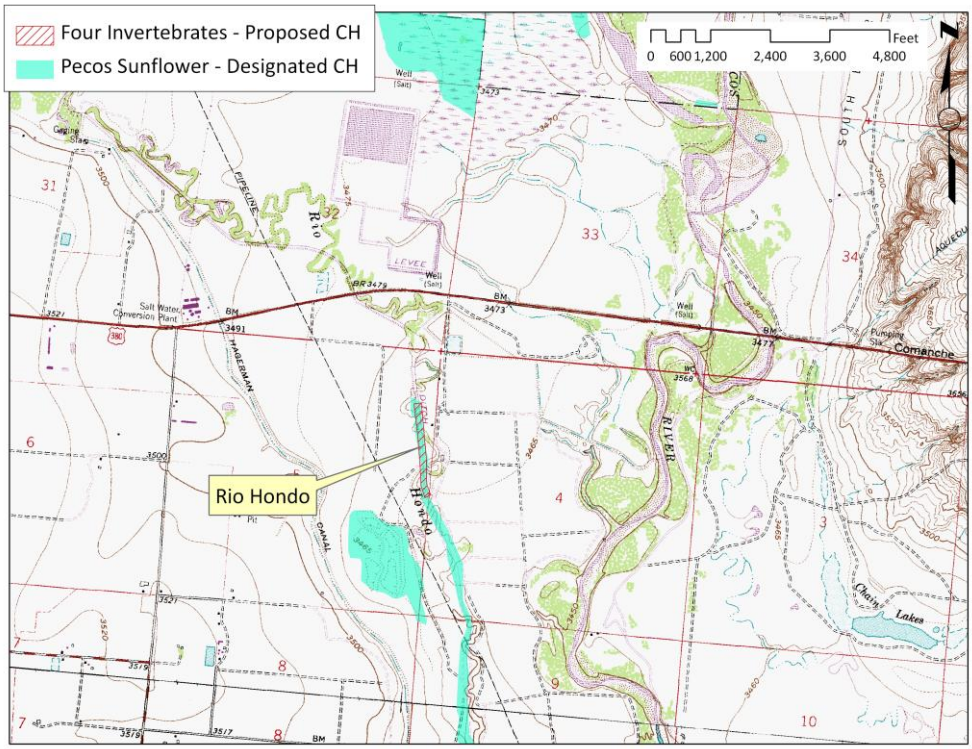


**Figure 12**. Overlap with Pecos sunflower critical habitat in Unit 3.



### 3.1.3 Impact Assessment Method

The consequences of section 7 consultation on potential effects to the four invertebrate species and critical habitat may be highly variable, depending on the characteristics, context, location, duration, geographic extent, and timing of each proposed action subject to consultation. This complexity is heightened by the dynamic nature of the natural environment. Biological conditions that influence the magnitude of potential impacts may change over time and from place to place. The complexity of the potential effects of critical habitat designation was addressed by using past section 7 consultations that involved the four invertebrate species and interviews with Service biologists on potential future consultation issues as a basis for the impact assessment.

The proposed action analyzed in this EA is a revision of critical habitat designation for the four invertebrate species. The No Action alternative was defined as the current condition, which is the four invertebrate species listed as endangered under the ESA and critical habitat designated only for Pecos assiminea at Diamond Y Spring (380 acres) and East Sandia Spring (16.5 acres), as described in the 2005 final rule (70 FR 46304: 46323).

A separate analysis of the incremental economic impacts of proposed critical habitat designation for the four invertebrate species was conducted and relevant results were incorporated into this EA (Industrial Economics, Inc., 2011). The economic analysis reports both the baseline economic impacts resulting solely from the four invertebrate species being listed as endangered, without any critical habitat, and the estimated incremental economic effects arising specifically from the proposed critical habitat designation.

The time frame for the analysis in this EA is 25 years. Recovery plans have not yet been developed for any of the four invertebrate species. However, 10 to 50 years is a typical time frame for recovery, with many plans forecasting recovery in a 10-year time frame following completion of the plan (General Accounting Office, 2006). Recovery of the four invertebrate species would presumably lead to their delisting, in which case critical habitat for the four invertebrate species would no longer be designated.

### 3.1.4 Summary of Section 7 Consultation Case Studies

Since June 1998, there have been 19 consultations with the Service on projects that included analysis of potential effects on the four invertebrate species. Fifteen of these (79 percent) were intra-Service consultations on projects proposed on Bitter Lake National Wildlife Refuge (12) or Diamond Y Spring (three). Three of the intra-Service consultations were formal and 12 were informal. The subjects of the remaining four consultations, all informal, were actions by other federal agencies: two by the Bureau of Land Management (BLM), one by the Animal and Plant Health Inspection Service (APHIS), and one by the Federal Emergency Management Agency (FEMA). These 19 section 7 consultations constitute the pool of case studies that form the basis of the analysis.

Forty-two percent (eight) of the section 7 consultations were conducted on vegetation management projects on Bitter Lake National Wildlife Refuge that involved herbicide treatments or mechanical removal of plants. One of these projects underwent formal consultation (consultation no. 22420-2006-F-0166). Five of the section 7 consultations (26 percent) were habitat restoration-related projects proposed by the Service at Diamond Y Spring or Bitter Lake National Wildlife Refuge. Two of these projects underwent formal consultation. One of the formal consultations was for removal of nonnative sheepshead minnow (*Cyprinodon variegatus*) from Diamond Y Spring (consultation no. 2-15-98-F1318) and the other was for rehabilitation of selected waterfowl management impoundments at Bitter Lake National Wildlife Refuge to

improve habitat for the four invertebrate species (consultation no. 2-22-03-F-159). Two of the consultations, both informal, were for fuel reduction or prescribed fire. One of these was proposed by the Service and the other was proposed by the BLM. The remaining four consultations, all informal, were for monitoring of Pecos pupfish on Bitter Lake National Wildlife Refuge (proposed by the Service), suppression of rangeland grasshoppers (proposed by APHIS), disaster area recovery (proposed by FEMA), and re-initiation of consultation by the BLM on the Habitat Protection Zone as a result of listing of the four invertebrate species.

# 3.2 Conservation of the Four Invertebrate Species

## 3.2.1 Existing Conditions

As described above in section 3.1.3, existing conditions are defined as listing of Roswell springsnail, Koster's springsnail, Noel's amphipod, and Pecos assiminea as endangered with 396.5 acres of critical habitat designated for Pecos assiminea, as described in the 2005 final rule (70 FR 46304). Under existing conditions, consultation with the Service would be triggered when a proposed federal action is likely to affect any of the four invertebrate species. This could include actions that directly or indirectly affect occupied habitat. Section 7 consultation would also be triggered when a proposed federal action is likely to affect designated critical habitat for Pecos assiminea at Diamond Y Spring or East Sandia Spring.

Because the four invertebrate species are listed as endangered, a federal action agency would make the initial determination of whether or not their action would affect any of the species. If the action agency determines that there would be no effect, they would not be required to consult with the Service. Section 7 consultation would be triggered when it is determined that the proposed federal action has the potential to affect any or all of the four invertebrate species. The four invertebrate species would receive protection from unauthorized take, which is defined to include not only physical harm to individuals but also significant habitat modification or degradation that results in impairment of behavioral patterns such as breeding, feeding, or sheltering.

Since June 1998, there have been 19 consultations with the Service on projects that included analysis of potential effects on the four invertebrate species. Fifteen of these were intra-Service consultations on projects proposed on Bitter Lake National Wildlife Refuge (12) or at The Nature Conservancy's Diamond Y Spring Preserve (three). The remaining four consultations were on projects proposed in the vicinity of Bitter Lake National Wildlife Refuge or the Diamond Y Spring Preserve.

One of the primary threats to the four invertebrate species is destruction or modification of their habitat (70 FR 46304: 46311-46315; New Mexico Department of Game and Fish, 2005). Surface water at many springs throughout the range of the four invertebrate species has been reduced or eliminated during the 20th century, and habitats at many remaining springs have been modified (New Mexico Department of Game and Fish, 2005). Conservation of the four invertebrate species depends upon protection of the few remaining habitats that they occupy because their geographic distribution is restricted to several small, isolated areas. Protection of habitat has been identified as a cornerstone in conservation of other listed springsnail species with restricted geographic distributions (*e.g.*, Service, 1994*a*; Service, 1995*a*; Service, 1995*b*; Service, 2002). Because all four of the invertebrate species have life spans of only about one year, even short-term impacts to habitat could result in elimination of populations or extinction of one or more of the species.

Both Bitter Lake National Wildlife Refuge and The Nature Conservancy manage habitat on their lands for conservation of the four invertebrate species and other rare or sensitive wetland-associated or aquatic species. For example, Bitter Lake National Wildlife Refuge constructed dikes to isolate the spring and seep habitats inhabited by the four invertebrate species from the impoundments managed primarily for waterfowl and shorebird habitat (consultation no. 2-22-03-F-159). Protection and restoration of listed species, including the four invertebrate species, are identified as management objectives at Bitter Lake National Wildlife Refuge (Service, 1998*a*).

The New Mexico Department of Game and Fish completed a recovery and conservation plan for the four invertebrate species in 2005 (New Mexico Department of Game and Fish, 2005). The plan identified a variety of conservation measures, such as reestablishing populations of the four invertebrates within their historic range. Implementation of conservation measures would require developing cooperative relationships with other entities, as there were no regulatory mechanisms available to the Department of Game and Fish for conservation actions. Note that in its proposed rule designating critical habitat (75 FR 35382), the Service determined it was unlikely that the four invertebrates could be restored to their historic range due to the decline of groundwater and subsequent loss of spring flows in the area, as well as other permanent habitat changes which would result in the inability to rehabilitate the lost habitat.

The Nature Conservancy intends to develop management plans for the Sandia Springs Preserve and the Diamond Y Spring Preserve. The Nature Conservancy continues to work with energy production companies at the Diamond Y Spring Preserve to reduce the potential for spills or leaks of oil into the Diamond Y Spring complex (J. Karges, The Nature Conservancy, pers. comm., 1 April 2010).

### 3.2.2 Effects on the Four Invertebrate Species

3.2.2.1 Alternative A - No Action Section 7 consultations pursuant to the critical habitat provisions of the ESA would be conducted only at the Diamond Y Spring and East Sandia Spring critical habitat units designated for Pecos assiminea, as described in the 2005 final rule (70 FR 46304: 46323). In a practical sense, this would mean that federal actions that are not expected to affect any of the four invertebrate species, but are planned in proposed critical habitat units 1 or 2 and that have proposed primary constituent elements, would not trigger section 7 consultation.

The conservation value of critical habitat designation for the four invertebrate species on Bitter Lake National Wildlife Refuge (Middle and South tracts) and adjacent City of Roswell land may not be realized with the No Action Alternative. Critical habitat designation provides a regulatory mechanism, through section 7 consultation, to evaluate the effects of proposed actions on key habitat features within areas that are essential to the conservation of the species. Thus, changes to important habitat characteristics, or primary constituent elements, could be tracked to ensure that critical habitats retain their value, capability, and potential for conservation of the species. These benefits to conservation of the four invertebrate species may not occur in proposed critical habitat units 1 and 2 with the No Action Alternative.

The non-regulatory aspects of critical habitat designation that would contribute to conservation of the four invertebrate species in proposed critical habitat units 1 and 2 may also not be realized with the No Action Alternative. These non-regulatory aspects include informing the public and private sector of areas that are important for species recovery, focusing attention on specific geographic areas that are essential to conservation of the four invertebrate species, identifying areas that may require special management considerations or protection, and providing protection to areas where significant threats to the species have been identified to help avoid accidental damage to such areas. These non-regulatory aspects of critical

habitat designation would be limited to the 396.5 acres of critical habitat designated for Pecos assiminea at Diamond Y Spring and East Sandia Spring in the 2005 final rule (70 FR 46304: 46323).

3.2.2.2 Alternative B - Proposed Action Alternative B, the proposed action, would have the effect of requiring section 7 consultation when proposed federal actions may affect primary constituent elements within the boundaries of the proposed revised critical habitat designation, consisting of about 515 acres, as described in section 2.3. Section 7 consultation on potential effects to primary constituent elements from actions on private lands within the critical habitat area would occur only when a federal action, such as funding or permitting, is involved.

Critical habitat designation provides a mechanism to ensure that habitat characteristics and function essential for conservation of the four invertebrate species are retained in the critical habitat units. In general, critical habitat designation is correlated with increased efforts to conserve listed species. Critical habitat designation helps to improve populations of listed species, increases knowledge about population trends and status, and contributes to meeting recovery goals (Hagen and Hodges, 2006). Taylor and others (2005) found that species with designated critical habitat in place for two or more years were "more likely to be improving and less likely to be declining" than species without designated critical habitat. However, in an economic analysis factors contributing to conservation status of listed species, Kerkvliet and Langpap (2007) did not find critical habitat to be a significant variable. Critical habitat designation may have conservation benefits to listed species even in areas that already have general protective regulations in place by providing species-specific conservation guidance (Hagen and Hodges, 2006).

Non-regulatory aspects of critical habitat designation (*e.g.* Suckling and Taylor, 2005) that would contribute to conservation of the four invertebrate species could be realized with implementation of Alternative B. These benefits may include informing the public and private sector of areas that are important for species recovery and where conservation actions may be most effective. Critical habitat designation focuses attention to and awareness of specific geographic areas that are essential to conservation of the four invertebrate species. Critical habitat also identifies areas that may require special management considerations or protection, and may help provide protection to areas where significant threats to the species have been identified to help to avoid accidental damage to such areas. When a federal agency proposes an action and can see that the action is located within the boundaries of a critical habitat unit, they can plan their projects in a proactive fashion consistent with section 7(a)(1) of the ESA.

# 3.3 Water Resources

## 3.3.1 Existing Conditions

The 500-year source-water capture zone for the springs that support the four invertebrate species on Bitter Lake National Wildlife Refuge was delineated in 1999 (Wolford *et al*., 1999). In 2002, there were 4,119 wells that withdrew 221,350 acre-feet of groundwater annually within the 12-township block that encompasses this source-water capture zone (New Mexico Department of Game and Fish, 2005). Irrigation accounted for 89 percent of the groundwater use, while domestic wells accounted for slightly less than three percent of groundwater use from the wells (New Mexico Department of Game and Fish, 2005).

The New Mexico Office of the State Engineer acknowledged a federal water right serving Bitter Lake National Wildlife Refuge "limited to existing conveyance depletions, as determined following a five year monitoring study pursuant to a Reserved Water Rights Stipulation dated December 6, 1996" (State of New

Mexico, 2002: 10). A reserved water right for the springs and impoundments at Bitter Lake National Wildlife Refuge has been quantified and settled. The water right protects existing aquatic habitat at the springs and impoundments as measured during the period from 1996 through 2001 (P. Tashjian, Service, pers. comm., 2 April 2010). This water right applies to the Sago Springs and Bitter Creek area, as well as to the seeps and springs that supply the impoundments on the Middle Tract of the refuge. The water right does not apply to the springs and seeps along the Rio Hondo on the South Tract of the refuge.

Current and future regulation of groundwater pumping in the Roswell Basin by the New Mexico Office of the State Engineer is likely to prevent any impacts to spring flows on the Middle Tract of Bitter Lake National Wildlife Refuge from groundwater withdrawal (State of New Mexico, 2002: 5). The New Mexico Office of the State Engineer has stated that "Administration of the basin protects all water users, including the Service, in times of drought and against overdiversion" and that "as a fully administered basin, any future effects on the water supply for these habitats would be due to a lack of recharge resulting from drought, and not from overpumping" (State of New Mexico, 2002: 10).

In Texas, East Sandia Spring is likely fed by shallow groundwater rather than the deeper aquifer in Cretaceous limestone that discharges at other springs in the area (Service, 2004*a*: 13-14). Water uses in the area around East Sandia Spring are primarily agricultural. The Reeves County Water Improvement District #1 diverts approximately 19,425 acre-feet of surface water from the local artesian spring system. The District provides irrigation water to about 10,600 acres along Toyah Creek, primarily within Reeves County but with a small portion in Jeff Davis County (Service, 2004*a*: 2-3). Extensive groundwater pumping for irrigation use also occurs in the area, although this has diminished in recent years due to the overall decline in agricultural production (Sharp, 2001). Diamond Y Spring discharges relatively saline water (Service, 1985: 6; 64 FR 56581: 56582) from the Rustler Aquifer (Boghici and Van Broekhoven, 2001: 212). Groundwater at the spring apparently is not suitable for irrigation, municipal, or domestic use because of the high salinity and mineral content (Service, 1985: 6). However, diversion of spring water and groundwater pumping in the area was implicated in the loss of flow at Leon Springs and the upper reaches of Leon Creek (45 FR 54678).

Over 90 percent of the water used in Pecos and Reeves counties in Texas is obtained from groundwater, and irrigation accounts for about 85 to 90 percent of water use in these counties (Boghici, 1999). The principal source of groundwater for irrigation, municipal, and industrial uses in Pecos and Reeves counties, Texas, is the Cenozoic Pecos Alluvium aquifer (Boghici, 1999). Anticipated demand for groundwater from this aquifer to the year 2030 is in excess of the estimated recharge rate. However, the Cenozoic Pecos Alluvium aquifer should have enough fresh water to meet anticipated needs although aquifer storage will likely be reduced. It is expected that aquifer storage would be reduced by about 561,459 acre-feet (6.8 percent) from 2000 to 2030 (Boghici, 1999). An application was recently made by Fort Stockton Holdings L.P. to the Middle Pecos Groundwater Conservation District for increased groundwater pumping in the Fort Stockton area (N. Allan, Service, pers. comm., 29 March 2010), but the application was deemed incomplete and the matter is now being litigated (Fort Stockton Pioneer, 2010).

There have not been any consultations on proposed water resources projects involving effects to the four invertebrate species. However, the Service did conduct formal consultation on the effects of continuing federal support for surface water irrigation operations by the Reeves County water Improvement District #1 on Comanche Springs pupfish and Pecos gambusia in the vicinity of East Sandia Spring (Service, 2004*a*). The Service determined that aquatic taxa inhabiting the spring outlets would not be adversely affected by ongoing surface water irrigation operations downstream. Reasonable and prudent measures specified in

the biological opinion focused on minimizing mortality of fish in irrigation ditches and did not have any bearing on taxa inhabiting the spring outlets.

All of the areas proposed for critical habitat designation are currently occupied by other listed species. Therefore, federal actions that may affect spring flows in habitats occupied by any of the four invertebrate species would trigger section 7 consultation on potential effects on other listed species. Measures to protect these other listed species (*i.e.*, Pecos sunflower, Pecos gambusia, Leon Springs pupfish, Comanche Springs pupfish) would likely be comprehensive enough to ensure protection of the four invertebrate species as well.

## 3.3.2 Effects on Water Resources

3.3.2.1 Alternative A - No Action With Alternative A, section 7 consultations on the effects of water projects would be required under the jeopardy standard when there is a federal nexus (*e.g.*, federal lands, permitting, or funding is involved). Water projects with a federal nexus that could substantially reduce or eliminate flow from springs, seeps, outflow channels, or wetlands inhabited by any of the four invertebrate species would likely trigger formal consultation under the jeopardy standard for the four invertebrate species as well as other aquatic or wetland-associated species that are listed under the Act. The effects of section 7 consultations on water resources projects would be similar to existing conditions, where consultations address potential effects on co-occurring aquatic or wetland-associated species that are already federally listed, such as Pecos sunflower, Pecos gambusia, Comanche springs pupfish, and Leon Springs pupfish (*cf.* section 3.1.2).

Section 7 consultation on effects of water projects with a federal nexus would be required under the adverse modification standard only at the Diamond Y Spring and East Sandia Spring areas that were designated for Pecos assiminea in the 2005 final rule (70 FR 46304: 46323). The Fort Stockton groundwater withdrawal proposal described above in section 3.3.1 does not appear to have any federal nexus and thus would not be subject to section 7 consultation under the critical habitat adverse modification standard if the project were to move forward.

3.3.2.2 Alternative B - Proposed Action Critical habitat designation under Alternative B is not likely to have any substantial additional effect on water resources compared to the No Action alternative. All of the critical habitat proposed under Alternative B is occupied by one or more of the four invertebrate species, and its conservation value rests mainly in the capability of the habitat to support existing populations (*cf.* section 3.1.1). Any action that reduces spring flow in occupied habitats to the point that the capability of the habitat to support one or more of the four invertebrate species is adversely affected is likely to result in an adverse effect determination under the jeopardy standard (Murphy, 2010). Critical habitat designation may result in additional discretionary conservation recommendations to reduce impacts to primary constituent elements related to spring flow. However, it is unlikely that reasonable and prudent alternatives developed under the jeopardy standard for water projects with a federal nexus would be changed substantially with the addition of critical habitat designation.

There would likely be overlapping conservation considerations for Pecos sunflower in designated critical habitat for that species in units 1, 2, 3, and 5 (Figures 9, 10, 11, and 12). A component of one of the primary constituent element for critical habitat of Pecos sunflower is permanently saturated soil in the top 20 inches of the soil profile, with salinity ranging from 10 to 40 parts per thousand (73 FR 17762: 17768). This primary constituent element relates directly to the hydrologic integrity of springs and seeps and intersects the hydrology-related primary constituent elements of proposed critical habitat for the four

invertebrate species (*cf.* section 1.4.1.3). Also, conservation considerations for critical habitat of Leon Springs pupfish in Unit 4 (Figure 10) would also likely overlap with those of the four invertebrate species. Therefore, additional section 7 impacts due to critical habitat designation for the four invertebrate species would be unlikely in the event that a water project with a federal nexus were to be proposed in any of these areas.

Critical habitat designation is unlikely to affect groundwater withdrawal actions in the Roswell Basin, because spring flows in the proposed critical habitat on Bitter Lake National Wildlife Refuge are already protected by existing water rights afforded by the New Mexico Office of the State Engineer's administration of the Roswell Basin. Bitter Lake National Wildlife Refuge has established a water right for the springs and impoundment areas that are being proposed for critical habitat designation. The Office of the State Engineer has stated that "both shallow and artesian pumping levels have stabilized and will continue to remain at relatively constant levels under basin administration" (State of New Mexico, 2002: 10). Thus, state regulation would prevent substantial, sustained draw-down of the groundwater sources that support the springs within proposed critical habitat, regardless of critical habitat designation.

# 3.4 Oil and Gas

## 3.4.1 Existing Conditions

Oil and gas operations in the region encompassing proposed critical habitat for the four invertebrate species are currently influenced by existing regulations, policies, and management plans. These existing conditions are described below and provide a baseline for assessing the potential additive or incremental effect of critical habitat designation on oil and gas operations.

In New Mexico, the recharge zone for the aquifer that supports the seeps and springs that compose proposed critical habitat units, including those in Unit 3 along the Rio Hondo, has been delineated (Wolford *et al*., 1999). A 12-township area[7] encompasses this 500-year source-water capture zone as well as the three proposed critical habitat units in New Mexico (Units 1, 2, and 5). There are several existing management considerations in the source-water capture zone that may influence oil and gas operations.

The 12-township area encompassing the source-water capture zone for the proposed critical habitat units in New Mexico contains 185 active natural gas or oil wells and 10 new wells in (Petroleum Recovery Research Center, 2011). To date, the 185 active wells have produced 30,654,256 cubic feet of natural gas and 90,165 barrels of oil. The wells in the source-water area have also produced 101,819 barrels of water over the same period (Petroleum Recovery Research Center, 2011). Sixty-eight percent of the active wells in the 12-township source-water capture zone are located on federal land. Seventeen percent of the active wells are located on private land and the remaining 16 percent are on state land. Nine of the 10 new wells in the 12-township source-water capture zone are on federal land; the other is on state land (Petroleum Recovery Research Center, 2011). All federal lands within the source-water capture zone are administered by the Bureau of Land Management.

[7] The 12 townships encompassing the source-water capture zone are: T 8S R 23E, T 8S R 24E, T 8S R 25E, T 9S R 23E, T 8S R 24E, T 9S R 25E, T 10S R 23E, T 10S R 24E, T 10S R 25E, T 11S R 23E, T 11S R 24E, and T 11S R 25E. This area also contains all of the proposed critical habitat units in New Mexico (Units 1, 2, and 5).

The Bureau of Land Management designated an area for protection of groundwater resources supplying springs at Bitter Lake National Wildlife Refuge (Bureau of Land Management, 2002). This area, referred to as the Habitat Protection Zone, includes all Bureau of Land Management administered oil and gas leases within the source-water capture zone. Stipulations for oil and gas well development in the Habitat Protection Zone include storage of drilling muds in steel tanks and use of cement to seal the entire length of the well casing (E. Jaquez, Bureau of Land Management, pers. comm., 7 April 2010).

There are 50 existing oil and gas leases in the Habitat Protection Zone (E. Jaquez, Bureau of Land Management, pers. comm., 7 April 2010). As of October 2009, there were 30 producing gas wells and no producing oil wells within the Habitat Protection Zone (H. Parman, Bureau of Land Management, pers. comm., 11 January 2011). Currently, there are three pending permits for oil and gas wells in the Habitat Protection Zone, but none of them have been acted upon and they are all nearing expiration (H. Parman, Bureau of Land Management, pers. comm., 11 January 2011). Oil and gas well development in the Roswell area, including the Habitat Protection Zone, is influenced primarily by the price of oil and gas. Therefore, the probable number of new oil and gas wells that may be developed within the Habitat Protection Zone over the next 20 years is unknown. Full development of oil and gas leases within the Habitat Protection Zone was estimated to be approximately 91 additional wells (Bureau of Land Management, 2006: 18).

In New Mexico, there are state-wide regulations governing protection of groundwater during oil and gas well installation and operation. The Oil Conservation Division of the New Mexico Energy, Minerals, and Natural Resources Department regulates oil and gas well drilling and casing in part to prevent contamination of groundwater (19 NMAC 15.3). For example, regulations at 19.15.3.106.A (Sealing Off of Strata) state that "During the drilling of any oil well, injection well or any other service well, all oil, gas, and water strata above the producing and/or injection horizon shall be sealed or separated in order to prevent their contents from passing into other strata." There are no known instances of groundwater contamination by leaking oil or gas wells in the source-water capture zone for the Middle Tract of Bitter Lake National Wildlife Refuge (New Mexico Energy, Minerals, and Natural Resources Department, 2011).

Surface spills of hydrocarbon liquids on Bitter Lake National Wildlife Refuge have been documented (Service 1994*b*; Service, 1996; Service, 1997*a*; Service, 1998*b*). However, none of these spills has resulted in contamination of surface water in habitats occupied by the four invertebrate species. There are no oil or gas wells or petroleum pipelines in close proximity to habitats occupied by any of the four invertebrate species in New Mexico.

In Texas, oil and gas wells are located on private lands and a federal nexus associated with oil and gas activities is largely lacking. Diamond Y Spring is located in the Gomez Ellenburger oil and gas field (Figure 5). The 22,000-acre Gomez Ellenburger field is one of the largest natural gas-producing fields in the U.S. (Smith, 2005). The field was discovered in 1962 and by 1993 over four trillion cubic feet of gas had been produced. Gas reserves in the field are deep, requiring wells to be drilled to depths of around 20,000 feet. Production from the field peaked in 1979 when there were 112 wells that produced 188,383,794,000 cubic feet of gas and 194 barrels of hydrocarbon liquids. Gas production then declined through the 1980s. By 1992, there were 94 wells producing 80,686,761,000 cubic feet of gas and 247 barrels of fluids annually (Smith, 2005). A gas plant is located about 0.25 miles due south of Diamond Y Spring. Oil and gas development in the vicinity of East Sandia Spring is sparse.

Surface spills of hydrocarbon liquids have occurred in the past at Diamond Y Spring and have resulted in fish kills (45 FR 54678). However, in the late 1970s, Trans Pecos Soil and Water Conservation District, in

cooperation with the Soil Conservation Service (now the Natural Resources Conservation Service), constructed a dike around the spring to prevent future oil spills from entering the spring habitat (Service, 1985: 7). Exxon also voluntarily placed oil pipelines above ground and in a double-casing in the vicinity of the spring and its outflow to prevent leaks into aquatic habitat (J. Karges, The Nature Conservancy, pers. comm., 1 April 2010).

There has been one section 7 consultation on an oil and gas project with federal involvement in the vicinity of habitats occupied by the four invertebrates. This was an informal consultation in 2004 regarding proposed abandonment of 58 miles of pipeline in Winkler, Ward, Reeves, and Pecos counties, Texas (consultation no. 2-15-04-I-0169). The proposed project involved permitting by the Federal Energy Regulatory Commission. It was determined that the proposed action would not have any effect on any of the four invertebrate species or any co-occurring, listed, aquatic taxa such as Leon Springs pupfish. There were no conservation recommendations made by the Service regarding protection of aquatic habitats in this consultation.

## 3.4.2 Effects on Oil and Gas

3.4.2.1 Alternative A - No Action With Alternative A, section 7 consultations on effects of oil and gas projects would be required under the jeopardy standard when there is a federal nexus (*e.g.*, federal lands, permitting, or funding is involved). The effects of section 7 consultations on oil and gas projects with a federal nexus would be similar to existing conditions, where consultations address potential effects on co-occurring aquatic and wetland-associated species that are already federally listed.

Proposed oil and gas well development on federal lands adjacent to Bitter Lake National Wildlife Refuge would be subject to section 7 consultation under the jeopardy standard for Pecos gambusia, the four invertebrate species, Pecos bluntnose shiner, and other listed species and also under the critical habitat adverse modification standard for Pecos sunflower. Stipulations required by the Bureau of Land Management and the New Mexico Oil Conservation Division regarding protection of groundwater and aquatic habitats during well development would be implemented.

Oil and gas well development in the vicinity of Diamond Y Spring and East Sandia Spring occurs on private lands with no federal involvement. Therefore, section 7 consultations would not occur for these projects.

3.4.2.2 Alternative B - Proposed Action Critical habitat designation under Alternative B would likely cause minor increases in time required by federal agency staff to conduct section 7 consultation, compared to existing conditions.

Designation of critical habitat for the four invertebrate species would not result in additional section 7 consultations on oil and gas projects with a federal nexus because all of the proposed critical habitat units are occupied by one or more of the four invertebrate species. Therefore, oil and gas projects with a federal nexus would trigger section 7 consultation under the jeopardy standard. Section 7 consultation on oil and gas development adjacent to Bitter Lake National Wildlife Refuge would be triggered under the jeopardy standard for the four invertebrate species and other listed species (*e.g.*, Service, 1997*b*), as well as the adverse modification standard for Pecos sunflower critical habitat. Potential effects to designated critical habitat for Pecos bluntnose shiner would also be included in such consultations (*e.g.*, Service, 1997*b*).

Potential impacts to any of the critical habitat units or the four invertebrate species from oil and gas projects would be to the quantity and quality of water flowing from springs and seeps. These impacts could result

from surface spills (including pipeline leaks), subsurface leakage from wells into groundwater, and alteration of groundwater flow from well installation. Regulations and management plans that are currently in place include measures to protect groundwater and surface water from impacts by oil and gas activities, including spills and leaks from pipelines or wells. Existing measures developed to protect spring flow and water quality in habitat occupied by Pecos gambusia (Service, 1997*b*), Leon Springs pupfish, Comanche Springs pupfish, Pecos sunflower and critical habitat of Pecos sunflower and Leon Springs pupfish would also protect the capability of habitat to support the four invertebrate species. Any impacts from oil and gas projects with a federal nexus that appreciably reduce the capability of critical habitat to sustain existing populations would also be subject to consultation under the jeopardy standard.

Inclusion of considerations for critical habitat for the four invertebrate species in section 7 consultations may result in the addition of discretionary conservation measures to reduce impacts to primary constituent elements related to spring flow and water quality. However, critical habitat designation for the four invertebrate species is not likely to result in substantive changes to mandatory reasonable and prudent alternatives.

# 3.5 Land Management

## 3.5.1 Existing Conditions

The Nature Conservancy manages lands they own consistent with their mission statement, which is to "preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive." Major land management activities conducted by The Nature Conservancy at the Diamond Y Spring Preserve and Sandia Springs Preserve include prescribed burning, removal of nonnative species such as salt cedar (*Tamarix chinensis*), and restoration of disturbed sites (J. Karges, The Nature Conservancy, pers. comm., 1 April 2010). For example, prescribed burning was conducted at Diamond Y Spring Preserve in January 2010 and in winter 2006-2007 (J. Karges, The Nature Conservancy, pers. comm., 1 April 2010). The Nature Conservancy coordinates with the Service on projects proposed on the preserves to ensure that actions are planned to optimize benefits to the four invertebrate species and other species of concern, such as other endemic aquatic invertebrates, Pecos sunflower, Leon Springs pupfish, and Comanche Springs pupfish (N. Allan, Service, pers. comm., 29 March 2010).

There have been three intra-Service section 7 consultations on projects proposed at Diamond Y Spring. Removal of nonnative fishes from Diamond Y Spring using antimycin, netting, and trapping was conducted in the past for conservation of Leon Springs pupfish (consultation nos. 2-15-98-F-1318 and 2-15-99-I-361). A stream discharge gage was also installed at the Diamond Y Spring outflow (consultation no. 2-15-99-I-067).

Bitter Lake National Wildlife Refuge is managed for wildlife conservation, which includes restoration and maintenance of biological integrity, diversity, and environmental health. Major land management activities on Bitter Lake National Wildlife Refuge include water level management in impoundments to provide habitat for waterfowl, shorebirds, and other groups of species, habitat restoration, prescribed burning, control of salt cedar, management of noxious weeds, and raising agricultural crops to provide food for wildlife (J. Sanchez, Service, pers. comm, 10 January 2011). Former moist-soil units on upland sites are also being restored to native grasslands and an oxbow on the floodplain of the Pecos River has been reconnected to the channel (J. Sanchez, Service, pers. comm., 10 January 2011).

There have been 10 intra-Service section 7 consultations on projects proposed on Bitter Lake National Wildlife Refuge. Six of these consultations were on projects to control noxious weeds and salt cedar using mechanical removal and herbicide treatments. Following are two examples of projects proposed on Bitter Lake National Wildlife Refuge.

The refuge proposed to conduct a prescribed burn in winter 2004-2005 at Unit 15 and to treat Russian knapweed (*Acroptilon repens*) along the west side of the unit using the herbicide imazapyr. These activities were planned within proposed critical habitat (consultation no. 2-22-05-I-0215). The refuge determined that the action may affect Koster's springsnail and Pecos assiminea. Measures proposed to minimize risk to these species were: 1) establishing a 50-yard buffer for herbicide treatments around habitats occupied by the species; 2) using a herbicide approved for use in aquatic habitats; 3) conducting prescribed burning during the winter when water levels at the springs and seeps are highest; and 4) conducting the prescribed burning using a head-fire, which would move through the area quickly and reduce the potential for development of high soil temperatures. The Service concurred that the project, as planned, would not adversely affect either Koster's springsnail or Pecos assiminea.

A formal intra-Service consultation was conducted on a project proposed in 2002 to rehabilitate impoundments on the refuge. One of the purposes of the project was to isolate springs and seeps along the west side of the impoundments from water level fluctuations in the impoundments for the purpose of protecting habitat for the four invertebrate species (consultation no. 2-22-03-F-159). The Service determined that the project was not likely to adversely affect the four invertebrate species. No project modifications were developed specifically for the four invertebrate species.

The Service is in the process of evaluating farming operations conducted on the South Tract of Bitter Lake National Wildlife Refuge (Service, 2010). The evaluation of farming operations on the South Tract was initiated to "determine the adequacy of the current farming practices in meeting the purpose of Bitter Lake National Wildlife Refuge and fulfilling the needs of migratory birds, threatened or endangered species, and other resident wildlife" (Service, 2010: 8). It is anticipated that the farming operations will be changed to eliminate cooperative (contract) farming, and any future actions would be limited to only Service-implemented farming operations on the South Tract (J. Sanchez, Service, pers. comm., 10 January 2011). Currently, the Service administers a cooperative farming program on the 500 farmable acres on the South Tract. At present, farming operations are conducted on about 330 acres. Farmed acreage may vary from 300 to 400 acres annually. The farming program on the South Tract involves raising green winter browse plants and cereal grains for feeding wintering cranes and waterfowl from October through February (Service, 2010: 14). Farmed lands are irrigated by pumping groundwater under water right RA-1510 (Service, 2010: 15).

The Service also implements integrated pest management to control nonnative, invasive weeds species and salt cedar. Currently, farmed land is separated from proposed critical habitat in Unit 3 (Rio Hondo) by a vegetative buffer that is 33 feet wide at the nearest point. However, now that Noel's amphipod is known to occur in the Rio Hondo on the South Tract, an increased buffer width will be established for application of herbicides. The Refuge establishes buffers around habitats that are occupied by threatened or endangered species when herbicide applications are proposed (Service, 2004*b*). The buffer width depends on the herbicide being used, and may range from 350 to 400 feet around the occupied habitat (Service, 2010: 43-44).

The proposed critical habitat areas on City of Roswell lands are largely contained within designated critical habitat for Pecos sunflower. All but 0.16 acres of the proposed critical habitat on City of Roswell land is within Pecos sunflower critical habitat (Figure 10). The City of Roswell land proposed for critical habitat for the four invertebrate species is unsuitable for commercial or residential use due to the high water table in the area and is, therefore, unlikely to be developed (Industrial Economics, 2011: 3-12 and 3-13).

## 3.5.2 Effects on Land Management

3.5.2.1 Alternative A - No Action Land management activities conducted on Bitter Lake National Wildlife Refuge, adjacent City of Roswell lands, the Diamond Y Springs Preserve, or the Sandia Springs Preserve would continue to be implemented as they have in the recent past. Both The Nature Conservancy and Bitter Lake National Wildlife Refuge would continue to plan and implement prescribed burning, noxious weed control, salt cedar removal, habitat restoration, and other projects for the benefit of the four invertebrate species and other aquatic and wetland species on their lands. Federal-supported or sponsored land management activities at Diamond Y Spring and East Sandia Spring would require analysis of potential effects to designated critical habitat for Pecos assiminea during section 7 consultation.

3.5.2.2 Alternative B - Proposed Action Compared to the No Action alternative, critical habitat designation would not have any effect on land management activities proposed on The Nature Conservancy preserves or Bitter Lake National Wildlife Refuge other than a minor increase in federal agency staff time under Alternative I to include critical habitat considerations in section 7 consultations.
Designation of critical habitat on Bitter Lake National Wildlife Refuge for the four invertebrate species may result in minor changes to buffer zones for application of herbicides to control invasive weed species (J. Sanchez, Service, pers. comm., 10 January 2011). The herbicide-application buffer would extend out from the perimeter of designated critical habitat, as opposed to the perimeter of occupied habitat. In the case of Unit 3 on the Rio Hondo, critical habitat designation would result in minor increases in the buffer area. This increase in buffer is not expected to substantially reduce farmable acreage with any of the action alternatives being considered in the ongoing evaluation of farming operations at the South Tract (Service, 2010: 44-45).

The ongoing evaluation of farming operations on the South Tract of Bitter Lake National Wildlife Refuge would continue regardless of whether or not critical habitat is designated in Unit 3 (J. Sanchez, Service, pers. comm., 10 January 2010). The evaluation of farming operations on the South Tract is an independent action that is not connected to or dependent upon proposed critical habitat designation (Service, 2010; J. Sanchez, Service, pers. comm., 10 January 2010).

Critical habitat designation may have a beneficial effect on land management activities at the Diamond Y Spring and Sandia Springs preserves. Critical habitat designation at these sites may increase the recognition of their importance in conservation of biological diversity and improve the potential for acquiring funding for habitat restoration and conservation work at these sites (J. Karges, The Nature Conservancy, pers. comm., 1 April 2010).

Critical habitat designation on 2.8 acres of City of Roswell property would not have any effect as no development of those areas is likely, due to the high water table. If a development proposal were to be made, there would likely be a federal nexus through Clean Water Act section 404 permitting for placement of fill in jurisdictional wetlands. In this case, both the jeopardy and adverse modification standards for both Pecos sunflower and the four invertebrate species would apply in section 7 consultation by the U.S.

Army Corps of Engineers (the permitting agency), with the likely result of reducing or avoiding adverse effects to critical habitat areas being required.

There are some military lands managed by the New Mexico Air National Guard located east of the Pecos River and the critical habitat areas (Bureau of Land Management, 2002: Appendix A). These lands are not near the critical habitat and are not within area that influences the source groundwater that provides water to the springs that serve as habitat to the four invertebrates. Therefore, any activities on these lands would not be affected by the critical habitat designation.

# 3.6 Livestock Grazing and Dairy Operations

## 3.6.1 Existing Conditions

Currently, no livestock grazing occurs on Bitter Lake National Wildlife Refuge on either the Middle or South tracts (J. Sanchez, Service, pers. comm., 10 January 2011). Livestock grazing occurred at the Diamond Y Spring Preserve until 2000 (J. Karges, The Nature Conservancy, pers. comm., 1 April 2010). A short-term, highly managed livestock grazing lease is scheduled to begin in Spring 2010 for the benefit of Pecos sunflower. Effectiveness of the grazing program in stimulating regeneration of Pecos sunflower will be evaluated on an annual basis and modified as needed (J. Karges, The Nature Conservancy, pers. comm., 1 April 2010).

Chaves County, New Mexico, is ranked 7th in the United States for milk production (New Mexico State University, 2011*a*). With 92,000 milk cows, dairy is the largest agricultural component in Chaves County, generating over $335 million income per year, and ranking 1st in New Mexico in milk production. Chaves County is also home to the world's largest mozzarella cheese factory (Chaves County Extension Office, 2011). In 2010, there were 40 dairy operations in Chaves County (Dairy Producers of New Mexico, 2011), which combined produced 1,941,200 pounds of milk (Development Corporation of Roswell, 2011). Dairy operations are primarily located south of Roswell in the Dexter and Hagerman area (New Mexico State University, 2011*b*), which is not within the source-water capture zone of springs and seeps in the Middle and South tracts of Bitter Lake National Wildlife Refuge.

Wastewater effluent discharge from dairy operations is regulated by a National Pollutant Discharge Elimination System (NPDES) General Permit for Discharge from Concentrated Animal Feeding Operations (permit no. NMG010000). The Eastern New Mexico State Fairgrounds also periodically operates under the NPDES General Permit for Concentrated Animal Feeding Operations, when the facility is in use (J. Lusk, Service, pers. comm., 24 January 2011). Runoff from the fairgrounds enters the Rio Hondo drainage. The Environmental Protection Agency is currently consulting with the Service to designate areas of concern for threatened and endangered species.

## 3.6.2 Effects on Livestock Grazing and Dairy Operations

3.6.2.1 Alternative A - No Action There would be no changes to existing livestock grazing conditions with implementation of Alternative A. Ongoing section 7 consultation on the NPDES General Permit for Concentrated Animal Feeding Operations would require consideration of impacts to the four invertebrate species and other listed species under the jeopardy standard. Additionally, analysis of potential effects to designated critical habitat for Pecos sunflower under the adverse modification standard would also be required.

3.6.2.2 Alternative B - Proposed Action Designation of critical habitat for the four invertebrate species with Alternative B would not have any substantial effects on livestock grazing and dairy operations compared to the No Action alternative. There would be minor increases in federal agency staff effort required to include critical habitat considerations in section 7 consultations on the NPDES General Permit for Concentrated Animal Feeding Operations. Additional discretionary conservation recommendations may be specified to reduce potential impacts to primary constituent elements of proposed critical habitat for the four invertebrate species. However, it is unlikely that any mandatory reasonable and prudent alternatives developed under the jeopardy standard for the four invertebrate species and other listed, aquatic species would be changed substantially with designation of critical habitat.

# 3.7 Roswell Wastewater Treatment Facility

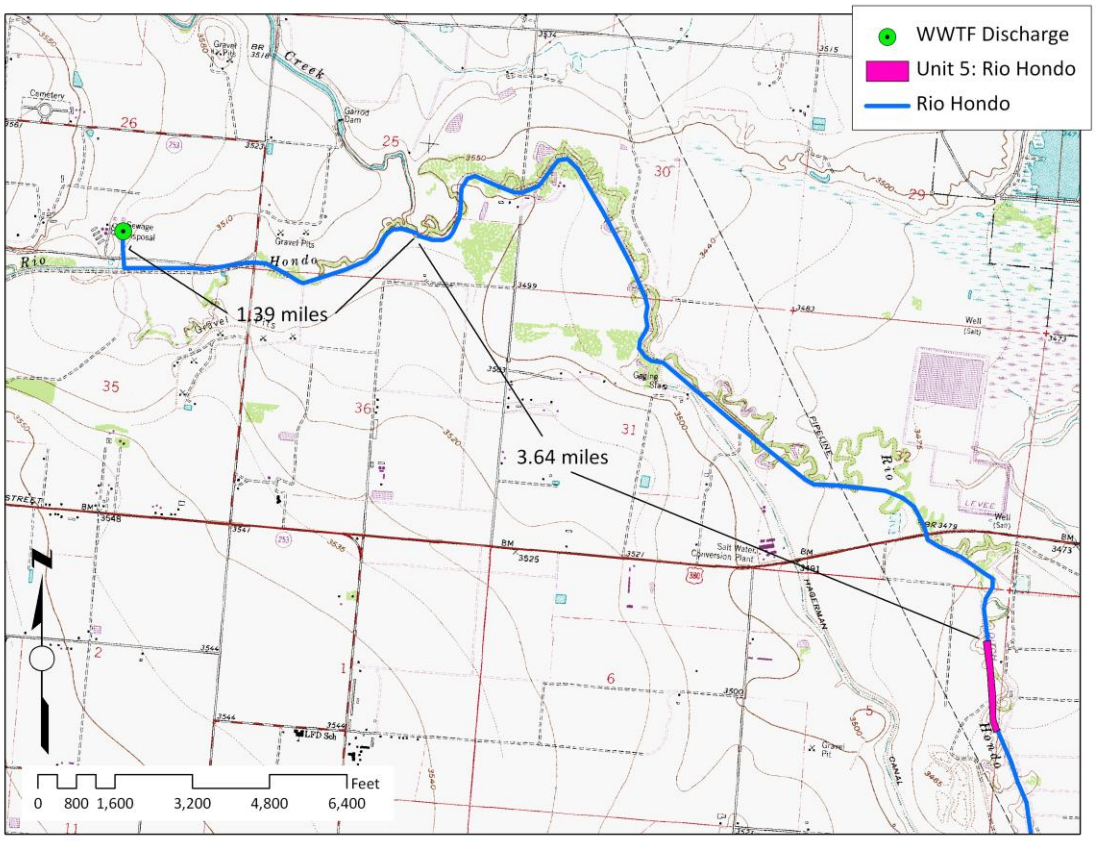
## 3.7.1 Existing Conditions

The City of Roswell wastewater treatment facility is located on the northeast side of the city near the confluence of Berrendo Creek with the Rio Hondo (Figure 13). The existing wastewater treatment facility was constructed in 1987 and the facility was expanded in 2007 to include activated sludge secondary treatment (City of Roswell, 2011). Discharge of treated effluent from the wastewater treatment facility is permitted under National Pollutant Discharge Elimination System (NPDES) Permit No. NM 0020311. The NPDES permitting system in New Mexico is currently implemented by the U.S. Environmental Protection Agency. However, the State of New Mexico is in the process of taking control of the permitting responsibilities (New Mexico Environment Department, 2011).

The wastewater treatment facility discharges to the Rio Hondo (NPDES Permit No. NM0020311). The design flow for the wastewater treatment facility is seven million gallons per day, but average daily flow during dry weather is about four million gallons per day. Discharge of treated effluent from the wastewater treatment facility maintains flow in the Rio Hondo downstream through the proposed critical habitat in Unit 3 (Figure 13). The upstream limit of proposed critical habitat in Unit 3 is 5.03 stream-channel miles downstream from the wastewater treatment facility discharge (Figure 13).

Treated effluent from the facility is tested regularly for biochemical oxygen demand (five days per week), total suspended solids (five days per week), fecal coliform bacteria (five days per week), and total mercury (once per month). Additionally, whole effluent toxicity is tested by bioassay using fathead minnow (*Pimephales promelas*) and the zooplankton *Daphnia pulex*. This testing is done once per quarter using a 24-hour composite effluent sample. Effluent is also required to have no detectable total residual chlorine (NPDES Permit No. NM0020311).

**Figure 13**. Location of the Roswell wastewater treatment facility discharge . The stream-channel distances between the discharge point and the confluence of Berrendo Creek, then downstream to proposed critical habitat Unit 3: Rio Hondo, located on the South Tract of Bitter Lake National Wildlife Refuge, are shown.



The wastewater treatment facility was out of compliance with the terms of the NPDES permit for eight of 12 quarters from October 2007 through September 2010 (U.S. EPA, 2011). IN seven of these eight noncompliance cases, the U.S. Environmental Protection Agency issued enforcement actions and compliance is pending. In the other case, there was reported non-compliance with the terms of the permit. None of the violations constituted significant non-compliance effluent violations (U.S. EPA, 2011).

The springs and seeps that are occupied by Noel's amphipod are located along the bank of the Rio Hondo and are typically above the water surface of the river during normal flows. However, the springs and seeps do flow into the river. During high flows, the springs and seeps that are occupied by Noel's amphipod may be inundated by river water, which during those times is a mixture of storm water runoff and treated effluent. Currently, the river itself is not suitable habitat for Noel's amphipod due to marked differences in water quality characteristics such as dissolved solids concentration, water temperature, and dissolved oxygen levels (J. Lusk, Service, pers. comm. 24 January 2011).

## 3.7.2 Effects on Roswell Wastewater Treatment Facility

3.7.2.1 Alternative A - No Action Current operation of the City of Roswell wastewater treatment facility, including treated effluent testing and discharge limitations, would continue as specified under NPDES Permit No. NM0020311. The existing permit expires on 30 November 2011 and renewal of the permit will require the U.S. Environmental Protection Agency to conduct section 7 consultation with the Service. The Service will likely examine effluent limitations more carefully now that Noel's amphipod is known to occur along the Rio Hondo. Potential effects of consultation may include recommendations to modify effluent characteristics to reduce risk to Noel's amphipod (J. Lusk, Service, pers. comm., 24 January 2011). Inundation of the springs and seeps inhabited by Noel's amphipod in Unit 3 may occur periodically during high flows in the Rio Hondo. In these instances, the springs and seeps would be inundated by water that is a mixture of treated effluent and storm water. Effects of inundation during high flows are unknown (J. Lusk, Service, pers. comm., 18 January 2011).

3.7.2.2 Alternative B - Proposed Action Designation of critical habitat with this alternative would not have any substantial, additional effects on operation and management of the City of Roswell's wastewater treatment facility compared to the No Action alternative. There would be minor increases in City of Roswell and federal agency staff effort required to include critical habitat considerations in section 7 consultations on the NPDES permit for the wastewater treatment facility when the current permit expires at the end of November 2011. Additional discretionary conservation recommendations to reduce potential impacts to primary constituent elements of proposed critical habitat for Noel's amphipod may be incorporated in the consultation. Inundation of the springs and seeps inhabited by Noel's amphipod in Unit 3 may occur periodically during high flows in the Rio Hondo. In these instances, the springs and seeps would be inundated by water that is a mixture of treated effluent and storm water. The specific effects on the species or its habitat from inundation during high flows are unknown (J. Lusk, Service, pers. comm., 18 January 2011). However, when river flows are high from flooding, storm water will substantially dilute wastewater effluent and, therefore, serve to reduce any potential effects to the species or its critical habitat from water contamination that might result from the water treatment plant effluent. In addition, any effects from the treatment plant that might undergo future section 7 consultation would be evaluated under the jeopardy standard. Any conservation measures that were an outcome of the consultation would not be appreciably different under an analysis for adverse modification of critical habitat. As a result of these factors, it is unlikely that significant effects on the operation of the Roswell wastewater treatment will result from the proposed action to designate critical habitat.

# 3.8 Recreation

## 3.8.1 Existing Conditions

Bitter Lake National Wildlife Refuge provides several types of public recreation opportunities. At the Middle Tract of the refuge, where most critical habitat is proposed, recreation activities include hunting, bird-watching, hiking, bicycling, and wildlife observation and photography (J. Niemann, Service, pers. comm., 2 April 2010). The South Tract is closed to public access except for one day in December each year when a special youth pheasant hunt is held (J. Saenz, Bitter Lake National Wildlife Refuge, pers. comm. 20 January 2011). The wildlife refuge averages 40,000 visitors annually (J. Niemann, Service, pers. comm., 2 April 2010).

A wildlife viewing route, which can be followed by auto, bicycle, or on foot, begins at the visitors' center and makes an eight-mile loop. The route borders the north side of Hunter's Marsh and south side of Impoundment 3 and encircles impoundments 5, 6, 7, and 15 (Figure 5). In the Middle Tract, public access is prohibited from the north boundary of the tract south to the wildlife viewing loop, which effectively excludes Impoundment3, Sago Springs, and Bitter Creek from public access. Wildlife viewing tours guided by refuge staff are conducted once a month from October through May. These tours allow participants into areas normally closed to the public.

Four short walking trails are located in the Middle Tract. A short walking trail (Butterfly Trail) leading from the visitors' center to an overlook, is located in Impoundment 5. Some spurs to this trail below the viewing platform encroach into the proposed critical habitat. A new visitors' center was constructed in 2007 along the driving route in this unit, but it is located outside the critical habitat boundaries. Three other trails (Dragonfly, Desert Upland, and Oxbow) with viewing platforms are also in the Middle Tract in s 6 and 7, but they are also generally outside of the proposed critical habitat boundaries. The Dragonfly Trail, for example, terminates at a viewing platform in Impoundment 6 that is located on the edge of critical habitat above the spring-fed ditch.

Hunting of waterfowl, upland birds, and deer is allowed only within certain portions of the refuge. Within the proposed critical habitat boundaries, hunting is allowed only in Hunter Marsh. Other hunting areas are in the Middle Tract, but outside of the critical habitat boundaries, and on the North Tract. About 250 hunters use the Middle Tract each year to hunt waterfowl.

The refuge has been the focus of a dragonfly festival one weekend each year from 2001 through 2009 (except for 2004). Attendance was estimated at 2,000 persons in 2008 and about 2,000 to 2,500 persons in 2009 (Friends of Bitter Lake National Wildlife Refuge, 2010). Attendance in 2010 was approximately 1,500 persons (J. Saenz, Bitter Lake National Wildlife Refuge, pers. comm., 19 January 2011). The event is sponsored by Friends of Bitter Lake National Wildlife Refuge, a non-profit group. The festival was originally held in Roswell with tours to the refuge, but it has evolved to be held on-site at the refuge for the past few years.

Recreation activities on The Nature Conservancy lands are allowed only by permission from The Nature Conservancy to ensure protection of the sensitive plant and animal species that occur on these lands. For example, Balmorhea Christmas Bird Count participants have been allowed to conduct bird surveys on the Sandia Springs Preserve. The Nature Conservancy hosts interpretive tours of each area for groups making such request. In recent years there have been no tours at Sandia Springs Preserve while Diamond Y

Springs Preserve annually has three to four tours. Tour groups typically consist of 10 to 20 people (J. Karges, The Nature Conservancy, pers. comm., 1 April 2010).

### 3.8.2 Effects on Recreation

3.8.2.1 Alternative A - No Action With Alternative A, the existing availability and management of public and private recreation activities would not be changed. Section 7 consultation on potential effects to the four invertebrate species and other listed species under the jeopardy standard would be required for recreation-related activities that have a federal nexus. Additionally, section 7 consultations would include analysis of effects on critical habitat for Pecos assiminea, and other species with designated critical habitat, under the adverse modification standard. Designation of critical habitat for Pecos assiminea has not affected recreation activities at The Nature Conservancy's Diamond Y Spring or Sandia Springs preserves.

3.8.2.2 Alternative B - Proposed Action Designation of critical habitat with this alternative would not affect existing public recreation uses at Bitter Lake National Wildlife Refuge. As the refuge is currently managed to protect the habitats of the four invertebrate species, future recreation developments would not be placed in these habitats, whether critical habitat is designated or not. Current recreation opportunities would continue to be provided to the public (J. Saenz, Bitter Lake National Wildlife Refuge, pers. comm., 20 January 2011).

Likewise, there would be no effect on recreation opportunities on The Nature Conservancy lands. The practice of managing these lands for conservation of Pecos assiminea, and other species, would continue to limit the availability of recreation activities (J. Karges, The Nature Conservancy, pers. comm., 1 April 2010).

## 3.9 Socioeconomic Conditions and Environmental Justice

Regulations for implementing NEPA require analysis of social effects when they are interrelated with effects on the physical or natural environment (40 CFR §1508.14). Federal agencies are also required to "*identify and address disproportionately high and adverse human health or environmental effects*" of their programs and actions on minority populations and low-income populations, as directed by Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations). Minority populations may be characterized by race or ethnicity. The 2000 U.S. Census provided for accounting of persons of Hispanic or Latino descent separate from racial groups, such as white, black or African American, Asian, and Native American. Therefore, for this analysis, both racial minority and Hispanic or Latino categories are considered when making environmental justice determinations.

## 3.9.1 Existing Conditions

3.9.1.1 Land Use The area proposed as critical habitat for the four invertebrate species includes three parcels in New Mexico and two parcels in Texas totaling about 521 acres. These five parcels are located in three counties: Chaves County, New Mexico; Reeves County, Texas; and Pecos County, Texas. The three proposed critical habitat units in New Mexico (Sago/Bitter Creek Complex, Impoundment Complex, and Rio Hondo), totaling 76.4 acres, are located primarily within the Bitter Lake National Wildlife Refuge, which is managed by the Service. The City of Roswell owns about 2.8 acres (3.7 percent) of the 76.4 acres proposed as the Impoundment Complex. The remaining two units (Diamond Y Spring Complex and East Sandia Spring) comprise 441.4 acres of private land in Texas owned by The Nature Conservancy. The Nature Conservancy lands are surrounded by other private lands. Bitter Lake National Wildlife Refuge is bordered by City of Roswell property, federal lands managed by the Bureau of Land Management, and by state and private lands.

The five proposed critical habitat units are located within public and private lands which are currently being managed, at least primarily if not exclusively, for protection of fish, wildlife, and plants and their habitats. Private and public lands adjacent to the national wildlife refuge generally support production of livestock and agricultural products, residential development, and oil and gas development.

As discussed in section 3.5, certain recreation activities are allowed at Bitter Lake National Wildlife Refuge, and The Nature Conservancy allows limited recreation activities by permission. The Nature Conservancy also allows local residents access through the Sandia Springs Preserve (which includes critical habitat Unit 5) for non-consumptive uses, such as visiting the community cemetery or walking (J. Karges, The Nature Conservancy, pers. comm., 5 April 2010).

3.9.1.2 Communities None of the five proposed critical habitat units is located in a developed community. Surrounding private lands are mostly ranch lands with occasional houses. Homes closest to the five proposed critical habitat units include a ranch house located a few hundred yards from East Sandia Spring and federal employee housing near the visitors' center at Bitter Lake National Wildlife Refuge. Communities closest to each of the proposed critical habitat units are shown in Table 3 along with their populations and approximate distance from their respective units.

**Table 3**. Communities and their populations nearest each proposed critical habitat unit (U.S. Census Bureau, 2010*a*). Distances between unit and nearest community are approximate.

| Critical Habitat Unit | Nearest Community | Population | Distance Between Critical Habitat Unit and Nearest Community |
|---|---|---|---|
| Sago/Bitter Creek Complex | Roswell, NM | 45,293 | 9 miles |
| Impoundment Complex | Roswell, NM | 45,293 | 9 miles |
| Diamond Y Springs Complex | Fort Stockton, TX | 7,846 | 10 miles |
| Rio Hondo | Roswell, NM | 45,293 | 9 miles |
| East Sandia Spring | Balmorhea, TX | 527 | 1 mile |

Fort Stockton, Texas and Roswell, New Mexico, the communities closest to three of the four proposed critical habitat units, are full-service communities with emergency services, schools, medical centers, and other community resources. Balmorhea, Texas, near East Sandia Spring, is a small village with few services located just south of Interstate 10. The closest full-service community to this unit is Fort Stockton, about 50 miles east on Interstate 10.

3.9.1.3 Economy The areas proposed as critical habitat for the four invertebrate species are rural lands currently being managed primarily for natural resource conservation. Lands surrounding the refuge and The Nature Conservancy lands are largely used for natural resource extraction activities (*i.e.*, oil and gas development, livestock grazing, and agricultural production).

Primary employment sources in Chaves, Reeves, and Pecos counties in 2003 were government, health care and social assistance services, and trade, transportation, and utilities (Industrial Economics, 2011: Appendix B, 3-4).

Major industries in these three counties, as determined by payroll, were health care and social assistance services, retail trade, transportation, manufacturing, and mining (Industrial Economics, 2011: Appendix B, 3-2). From 2000 to 2009, the population of Chaves County is estimated to have grown by 3.6 percent. During the same period, the populations of Reeves and Pecos counties each lost population at rates of 15.9 percent and 3.3 percent, respectively (U.S. Census Bureau, 2010*b*).

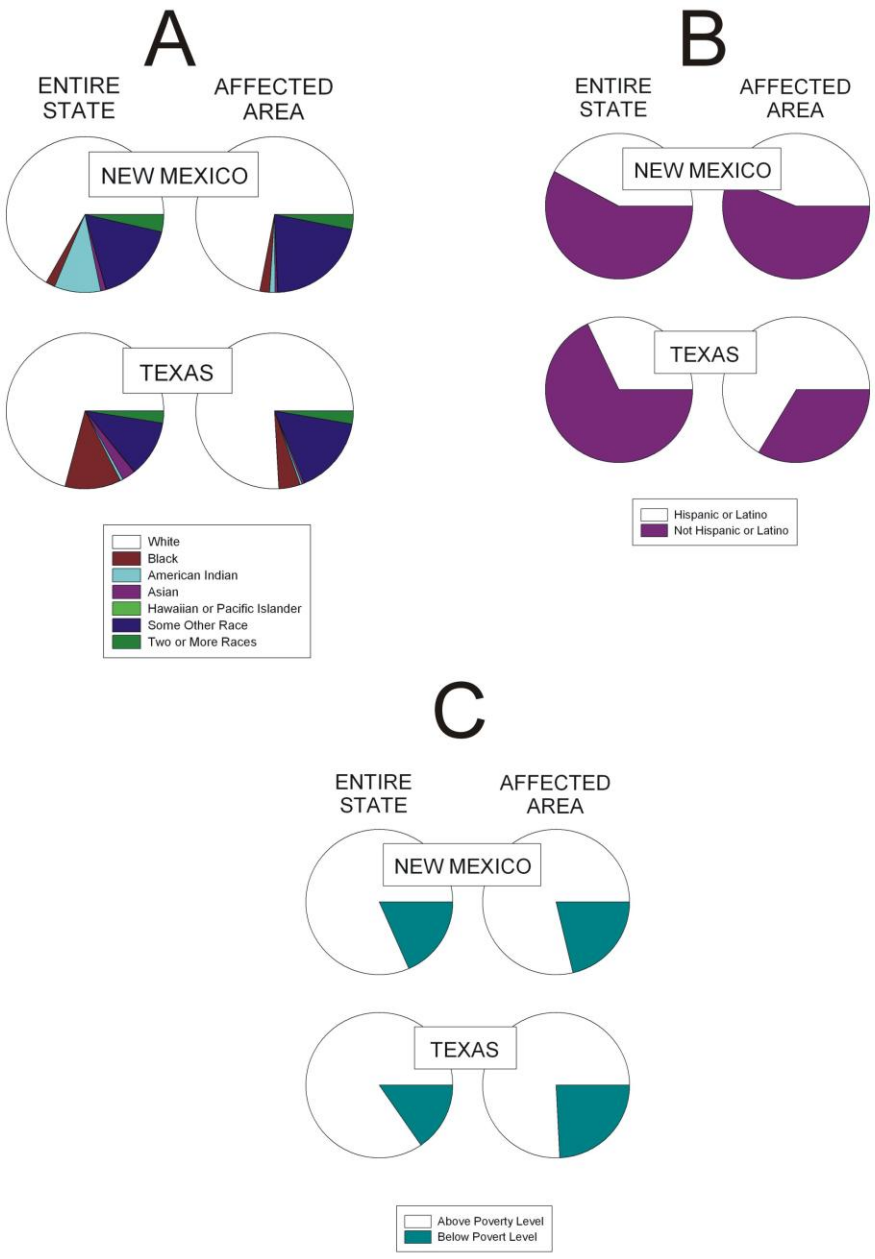
3.9.1.4 Environmental Justice The estimated 2010 population of New Mexico and Texas and the combined estimated population of their associated counties is shown in Table 4.

**Table 4**. Estimated population of the project area **.** The table shows population estimates of the two states and combined population of counties within each state that are included in the areas proposed for designation of critical habitat for the four invertebrate species. Estimates are from 1 July 2009 (U.S. Census Bureau, 2010*b*).

| State | Estimated State Population | Estimated Population of Counties with Proposed Designated Habitat in Each State |
|---|---|---|
| New Mexico | 2,009,671 | 63,622 |
| Texas | 24,782,302 | 27,294 (Pecos and Reeves combined) |

Selected Census 2000 population demographics of these states are compared to the demographics of the combined potentially-affected counties within each state in Figure 14. The demographics selected for comparison include the composition of populations in 2000 based on: 1) race (Figure 14A); 2) persons of Hispanic or Latino origin versus other origins (Figure 14B); and 3) persons with income below and above the poverty level (Figure 14C). The purpose of selecting these demographics is for making a determination as to whether or not implementation of the proposed action would disproportionately adversely affect minority or low-income groups in accordance with Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.

**Figure 14**. Demographic characteristics of the project area **.** Selected Census 2000 demographics for population of the State of New Mexico compared with Chaves County, New Mexico and the State of Texas compared with the combined population of Reeves and Pecos counties, Texas (U.S. Census Bureau, 2010*a*; U.S. Census Bureau, 2010*c*).



In 2000, both New Mexico and Texas had slightly lower percentage of white persons statewide than in their respective counties in the affected project area (Figure 14A). Conversely, the population of Chaves County, New Mexico and the combined populations of Reeves and Pecos counties in Texas had slightly lower percentages of racial minorities than were found in the overall populations of their respective states (Figure 14A). About 66.8 percent of all New Mexicans were white while 72 percent of Chaves County citizens were white. Statewide, 71 percent of the Texas population was white while 75.8 percent of the combined population of Reeves and Pecos counties was white.

The breakdown between Hispanic or Latino and non-Hispanic or Latino populations was about the same statewide in New Mexico as compared to Chaves County (Figure 14B). About 42.1 percent of New Mexico citizens were Hispanic or Latino while 43.8 percent of Chavez County residents were Hispanic or Latino. There was a substantial difference, though, between the population of Texas and its potentially-affected counties when comparing Hispanic or Latino populations. About one-third of the population of Texas was Hispanic or Latino, but approximately two-thirds of the population of Reeves and Pecos counties was Hispanic or Latino (Figure 14B).

In 1999, there was a slightly higher percentage (three to four percent) of persons in Chaves County living below the poverty level than those across the entire state of New Mexico (Figure 14C). Within the affected county areas in Texas, substantially more (approximately seven to nine percent) individuals are living below the poverty level than the statewide average for Texas (Figure 14C).

## 3.9.2 Effects on Socioeconomic Conditions and Environmental Justice

3.9.2.1 Alternative A - No Action Section 7 consultation under the jeopardy standard would be required on federal actions that have the potential to affect habitat occupied by the four invertebrate species. Actions on private lands that have the potential to result in take of any of the these species would be subject to section 10 of the ESA, which requires development of a Habitat Conservation Plan as part of an application to the Service for an incidental take permit. Also, section 7 consultation under the adverse modification standard would be required on federal actions that have the potential to affect designated critical habitat for Pecos assiminea at Diamond Y Spring and East Sandia Spring. Baseline costs for conservation of the four invertebrate species under 2011 conditions was estimated to range from $108,000 to $147,000 annually (Industrial Economics, 2011: Exhibit ES-3 on page ES-7).

3.9.2.2 Alternative B - Proposed Action Land use in and surrounding the proposed critical habitat units is not expected to change with the proposed action compared to the no action alternative. Federal and private lands within and adjacent to proposed critical habitat units that are currently managed for conservation of wildlife and their habitats would continue to be managed for conservation purposes (*i.e.*, Bitter Lake National Wildlife Refuge and The Nature Conservancy preserves) or for multiple public uses (*i.e.*, Bureau of Land Management lands). The small portion of proposed critical habitat owned by the City of Roswell has largely been designated as critical habitat for the Pecos sunflower and is unsuitable for development (Industrial Economics, 2011: 3-12).

Designation of critical habitat with Alternative B would not affect community services or community cohesion. No residences or businesses would be displaced. Community resources such as schools, law enforcement, medical services, and social services, would not change as a result of designation of critical habitat.

The economic analysis estimated an annual cost of $6,420 as a result of designation of revised critical habitat for the four invertebrate species (Industrial Economics, Inc., 2011: ES-6). About 84 percent of these estimated costs are attributed to intra-Service section 7 consultations ($3,353/year) and Bureau of Land Management section 7 consultations ($2,050/year; Industrial Economics, Inc., 2011: Exhibit ES-3 on page ES-7). The remaining estimated costs ($1,018 per year) are associated with the cost of section 7 consultations for concentrated animal feeding operations ($820/year) and the City of Roswell wastewater treatment facility ($198/year; Industrial Economics, Inc., 2011: Exhibit ES-3 on page ES-7).

The economic analysis indicated that there may be potential direct and ancillary benefits associated with the proposed action. These include enhancing the experience of wildlife enthusiasts visiting critical habitat areas, improving the overall ecological health of the critical habitat areas, protection of groundwater quality, and improvements to ecosystem health that are shared by other, coexisting species (Industrial Economics, 2011: ES-9 and ES-10).

As no measurable detrimental effects from the designation of critical habitat are anticipated in regards to communities or individuals (*e.g.* loss of homes, businesses, or jobs; disruption of community services or community cohesion), there would be no disproportionate adverse effects on low-income or minority populations. The proposed action is in compliance with E.O. 12898.

## 3.10 Cumulative Effects

Cumulative effects are the effects from other projects that are not part of this proposed action, which may have an additive effect when combined with the effects expected from the proposed action. The geographic extent for which cumulative effects are considered vary for each resource. The past, present, and reasonably foreseeable future actions in the proposed critical habitat analysis area that, combined with the proposed action, could contribute to cumulative effects include:

- effects of listing, critical habitat designation, and section 7 consultations for other species and other designated critical habitats; and

- existing land management policies and plans.

Effects of proposed critical habitat designation on most resource areas generally consist primarily of the potential for minor increases in federal agency staff effort during section 7 consultations to incorporate critical habitat considerations and addition of discretionary conservation measures to reduce impacts to primary constituent elements. These potential impacts are not likely to result in substantial cumulative effects, when added to the effects of existing section 7 consultations for other species and existing land management plans and policies.

## 3.11 Relationship Between Short-Term and Long-Term Productivity

Proposed designation of critical habitat is a programmatic policy that would have no effect on short-term or long-term productivity.

## 3.12 Irreversible and Irretrievable Commitment of Resources

Irreversible commitments of resources are those effects that cannot be reversed. For example, the extinction of a species is an irreversible commitment. Irretrievable commitments of resources are those that are lost for a period of time, but may be reversed, such as building a shopping center on farmland. The land cannot be used for farming again until the pavement is removed and soils are restored to productivity. Designation of critical habitat for the four invertebrate species would result neither in irreversible or irretrievable commitments of resources.

# 4.0 COUNCIL ON ENVIRONMENTAL QUALITY ANALYSIS OF SIGNIFICANCE

Pursuant to the Council on Environmental Quality regulations for implementing NEPA, preparation of an environmental impact statement is required if an action is determined to significantly affect the quality of the human environment (40 CFR §1502.3). Significance is determined by analyzing the context and intensity of a proposed action (40 CFR §1508.27).

Context refers to the setting of the proposed action and includes consideration of the affected region, affected interests, and locality (40 CFR §1508.27[a]). The context of both short- and long-term effects of proposed designation of critical habitat are the proposed critical habitat units in Chaves County, New Mexico and Pecos and Reeves counties, Texas, totaling about 515 acres, and the surrounding areas. The effects of proposed critical habitat designation at this scale, although long-term, would be small.

Intensity refers to the severity of an impact and is evaluated by considering ten factors (40 CFR §1508.27[b]). The intensity of potential impacts that may result from designation of critical habitat for the four invertebrate species with the proposed action (Alternative B) is low.

- The potential impacts may be both beneficial and adverse, but minor.
- There would be no effects to public health or safety from proposed designation of critical habitat.
- The proposed action may provide a small benefit to wetlands and ecologically critical areas, and would not affect other unique characteristics of the geographic area.
- Potential impacts from critical habitat designation on the quality of the environment are unlikely to be highly controversial.
- Potential impacts from critical habitat do not involve a high degree of uncertainty, or unique or unknown risks.
- Proposed designation of critical habitat for the four invertebrate species does not set a precedent for future actions with significant effects.
- Proposed designation of critical habitat would not result in significant cumulative impacts.
- Significant cultural, historical, or scientific resources are not likely to be affected by proposed designation of critical habitat.
- Critical habitat designation may have a beneficial effect on the four invertebrates.
- Critical habitat designation would not violate any Federal, state, or local laws or requirements imposed for the protection of the environment.

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